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The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

David W. Stinson, Ph.D.
Committee Chair

Audrey J. Leroux, Ph.D.
Committee Member

Laurn Jordan, Ph.D.
Committee Member

Miles A. Irving, Ph.D.
Committee Member

Date

Gertrude Tinker Sachs, Ph.D.
Chairperson, Department of
Middle and Secondary Education

Paul A. Alberto, Ph.D.
Dean, College of Education &
Human Development

AUTHOR'S STATEMENT

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ERVIN J. CHINA

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Ervin Jamar China
Department of Middle and Secondary Education
College of Education and Human Development
Georgia State University

The director of this dissertation is:

David W. Stinson, Ph.D.
Department of Middle and Secondary Education
College of Education and Human Development
Georgia State University
Atlanta, GA 30303

CURRICULUM VITAE

Ervin J. China

ADDRESS: 210 Villa View Way
Hampton, GA 30228

EDUCATION:

Doctor of Philosophy	Georgia State University, 2019 Teaching & Learning –Mathematics Education
Master of Arts	Eastern Michigan University, 2009 Mathematics
Bachelor of Science	Morehouse College, 2007 Mathematics

PROFESSIONAL EXPERIENCE:

2019–present	Lecturer, Department of Mathematics Clayton State University – University System of Georgia
2013–present	Mathematics Instructor & Program Coordinator for Learning Support Southern Crescent Technical College – Technical College System of Georgia
2013–present	Mathematics Instructor, Adjunct Gordon State College – University System of Georgia
2010–2013	Mathematics Instructor Central Georgia Technical College – Technical College System of Georgia

PRESENTATIONS AND PUBLICATIONS:

China, E. J., (2014). And then there was light: A book review of *The brilliance of black children in mathematics: Beyond the numbers and toward new discourse*. *Journal of Urban Mathematics Education*, 7(1), 88–95.

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

2012–present	National Association for Developmental Education (NADE)
2013–present	Georgia Association for Developmental Education (GADE)
2012–present	Georgia Mathematical Association of Two-Year Colleges
2010–present	Morehouse College Alumni Association

INVESTIGATING COLLEGE ALGEBRA HELP-SEEKING BEHAVIORS OF AFRICAN AMERICAN COMMUNITY COLLEGE STUDENTS: A HIERARCHICAL LINEAR MODELING APPROACH

by

ERVIN J. CHINA

Under the Direction of David W. Stinson, Ph.D.

ABSTRACT

When students experience difficulty with their coursework, they often utilize strategies such as rereading a text more slowly, organizing class notes, reviewing previous examples, or searching for information available on the Internet. If these efforts are ineffective, students may also consult their teachers, classmates, friends, or parents for assistance. Until recently, such reliance on others was considered of limited value and even stigmatized: the criticism being that learners who are truly independent are not supposed to need others to succeed (Karabenick & Newman, 2011). Recent theoretical developments and research, however, indicate that academic help seeking can be an important self-regulated learning strategy engaged in by highly motivated and academically successful students (Karabenick & Newman, 2011).

But help seeking for some students is not without risk. Help seeking can imply inadequacy, threaten self-worth, and subject learners to public scrutiny (Karabenick & Newman, 2011). Being viewed as less capable by teachers, other students, or anyone in an evaluative position could be disconcerting—especially for African American students in mathematics

classes where there exists the idea that they are incapable of meaningful participation in mathematics (see, e.g., Jefferson, 1787; Kopan, 2015; Nisbett, 2007; Powell, 2012).

This quantitative research study, therefore, was intended to gain a better understanding of the factors that influence help-seeking behaviors of African American College Algebra students at the community college. The purpose was to inform community college mathematics instructors about efforts that might begin to break down teacher–student barriers so that students feel comfortable and encouraged asking for help. Grounded in self-regulated learning and achievement goal theories, this study employed hierarchical linear modeling (HLM) and multiple regression analyses to investigate the help-seeking behaviors of 341 African American community college students in 48 College Algebra classrooms. Students completed help seeking scales adapted for College Algebra (see Cheong, Pajeres, & Oberman, 2004), the Attitude Toward Mathematics Inventory (Tapia & Marsh, 2002), and the Professorial Concern Scale (Winston, Vahala, & Gills, 1989). Student-level (e.g., mathematics attitude, professorial concern, age, gender, and developmental status) and classroom-level characteristics (e.g., teacher sex and average classroom age) significantly predicted reported levels of help seeking. Implications and suggestions for future research are discussed.

INDEX WORDS: Academic help seeking, African Americans, Community college, College algebra, Hierarchical linear modeling, Mathematics

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ERVIN J. CHINA

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in

Teaching and Learning with a Concentration in Mathematics Education

in

the Department of Middle and Secondary Education

in

the College of Education and Human Development

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Atlanta, GA
2019

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DEDICATION

To my mother, Carlie, my father, Ervin, and my sisters, April and
Avis, whose support, encouragement, and faithful prayers made
this volume possible—with love and thanks.

—Poppie

TABLE OF CONTENTS

LIST OF TABLES	iv
LIST OF FIGURES	v
CHAPTER 1 INTRODUCTION	1
Purpose.....	3
Research Questions.....	5
Significance of the Study	6
CHAPTER 2 LITERATURE REVIEW	8
Academic Help Seeking.....	8
Academic Help Seeking: From Elementary School to College.....	10
Academic Help Seeking in Online Environments.....	14
Other Predictors of Help-Seeking Behaviors: Perception of the Teacher and Attitudes.....	16
<i>Perceptions of the Teacher's Concern</i>	19
<i>Attitudes Toward Mathematics</i>	21
CHAPTER 3 CONCEPTUAL FRAMEWORK	24
Self-Regulated Learning	24
The Pintrich Model of Self-Regulated Learning	25
<i>Planning</i>	26
<i>Monitoring</i>	28
<i>Control</i>	29
Achievement Goals and Help Seeking	31
Performance and Mastery Goal Orientations.....	33
Performance-Avoidance Goal Orientation: Implications for African American Students	36
Limitations of Self-Regulated Learning and Achievement Goal Theories	38
CHAPTER 4 METHODOLOGY	41
What is Hierarchical Linear Modeling?	41
Benefits of Hierarchical Linear Modeling.....	42
How a Hierarchical Linear Model is Constructed.....	45
<i>Level of Hierarchical Data Structure</i>	45
<i>Fixed and Random Coefficients</i>	46
<i>Intraclass Correlation Coefficient</i>	47
Participants and Instruments	48
<i>Participants</i>	48
<i>Attitudes Toward Mathematics</i>	48
<i>Classroom Environment: Perceptions of the Teacher as Supportive</i>	50
<i>Help-seeking Behaviors: The College Algebra Help Seeking Scales (CAHSS)</i>	52

Model for the Present Study	53
CHAPTER 5 RESULTS.....	58
Demographic Characteristics.....	58
Outcome Variables	60
<i>College Algebra Help Seeking Scales</i>	60
Predictor Variables	63
<i>Attitude Toward Mathematics</i>	63
<i>Professorial Concern</i>	64
Results of Analysis	68
<i>Avoidance Help Seeking</i>	68
<i>Instrumental Help Seeking</i>	72
<i>Executive Help Seeking</i>	73
Summary.....	75
CHAPTER 6 DISCUSSION.....	76
Summary of the Study.....	76
Findings.....	77
<i>Demographics</i>	77
<i>Student-level Predictors of Avoidance of Help Seeking</i>	78
<i>Student-level Predictors of Instrumental and Executive Help Seeking</i>	79
<i>Classroom-level Predictors of Help Seeking</i>	80
Limitations.....	80
<i>Sampling Bias</i>	81
<i>Missing and Deleted Data</i>	82
Suggestions for Future Research.....	83
Implications and Closing Thoughts	84
REFERENCES.....	86
APPENDIX A	102
APPENDIX B	104
APPENDIX C	106

LIST OF TABLES

Table 3.1: Phases of Self-regulated Learning.....	27
Table 3.2: Mastery- and Performance- Approach/Avoidance Scenarios.....	35
Table 5.1: Descriptive Statistics for Participant Demographics.....	59
Table 5.2: Bivariate Relationships Instrumental, Executive, & Avoidance of Help Seeking.....	60
Table 5.3: Instrumental Help Seeking Results	61
Table 5.4: Executive Help Seeking Results	62
Table 5.5: Avoidance of Help Seeking Results	63
Table 5.6: Attitude Toward Mathematics Inventory Results	65
Table 5.7: Professorial Concern Results	66
Table 5.8: Cronbach Alphas, Means, and Standard Deviations for Scales	66
Table 5.9: Descriptive Statistic for Classroom-level Variables	67
Table 5.10: Bivariate Relationships between Student-level Variables	67
Table 5.11: Bivariate Relationships between Classroom-level Variables	67
Table 5.12: Parameter Estimates for Avoidance of Help Seeking	71
Table 5.13: Regression Analysis Predicting Instrumental Help Seeking	73
Table 5.14: Regression Analysis Predicting Executive Help Seeking	74

LIST OF FIGURES

Figure 4.1: Network Graph Depicting Three-Level Nested Structure.....	45
Figure 5.1: Interaction between Teacher Gender and Avoidance of Help Seeking	72

CHAPTER 1

INTRODUCTION

In this chapter, I begin by discussing the importance of our nation's community colleges and make an argument for their appeal. I then offer a perspective of the help-seeking dilemma from my own personal experience as a mathematics instructor. Last, I provide the reader with the purpose of my research study, the research questions that guided the inquiry, and an explanation for why this scholarship is significant to mathematics education.

With the exorbitant tuition of some of our nation's 4-year colleges and universities, the idea of attending community college is increasingly becoming a consideration for high school graduates (see, e.g., Kasper, 2002). Besides the fact that community college tuition tends to be cheaper (National Center for Education Statistics, 2016), class sizes are generally small, thus, allowing students the opportunity to receive more individualized attention and nurturing from their professors (see, e.g., DeWine et al., 2017; Townsend & Wilson, 2006). Additionally, students have the option of completing their core classes (such as English and mathematics) while at the community college and possibly transferring to the 4-year college from which they may have been rejected initially. Thus, the community college, for some students, serves as a stepping-stone to a 4-year college (Monaghan & Attewell, 2015). Furthermore, community colleges tend to offer a more flexible schedule, offering more classes at night so that students can work during the day—a benefit especially appealing to adult learners with families (see, e.g., Kurlaender, 2006; Montero-Hernandez & Cerevan, 2012).

Community colleges provide access to higher education for a wide range of student populations, “including large numbers of racial/ethnic minorities, low-income students, first-generation college students, adult learners, and recent immigrants” (Malcom, 2012, p. 19). Indeed, students from these groups are most likely to attend community colleges over 4-year

colleges (Malcom, 2012), but once they enter, these students are often placed in developmental studies courses¹ because of their failure to meet placement test cut-off scores. Of all the courses taught at community colleges, there are likely no other courses with such a high concentration of African American and Hispanic students than the developmental studies courses—largely developmental studies mathematics (see, e.g., Attewell et al., 2006; Bahr, 2008).

Once these students finish their developmental sequence, they enroll in the credit-bearing course, usually College Algebra—the last course between them and graduation. For the past 9 years, I have had the privilege of teaching for the Technical College System of Georgia, and every semester I experience the joy of teaching a College Algebra course; it is one of my favorite courses to teach. Unfortunately, however, as the algebraic concepts of linear, quadratic, exponential, and logarithmic functions become increasingly difficult, too many of my students do not seek the help they need—despite my incessant pleas for them to visit the free tutoring center or my invitations for individualized help during my office hours. The students that do seek help are often the ones who are already performing well and wish to maintain their good performance. Thus, the students who need help the most often do not seek it.

Interestingly, I find that the students who do seek my help (or help from others) are overwhelmingly women. Perhaps it is my devastatingly good looks and Carolina charm that make these students more inclined to seek out my assistance (Benson, Karabenick, & Lerner, 1976). On the other hand, perhaps it is my expressiveness or the presumption of my queerness, which some may find threatening or even off-putting, that makes my male students less inclined

¹ Traditionally (and sometimes callously) referred to as “remedial,” the term developmental (or learning support, as it is referred to at some colleges) describes courses intended to serve students that are academically underprepared before entering college.

to seek my help. Though I cannot change my personal characteristics, this help-seeking dilemma (Nadler, 1998) is one that interests me.

Purpose

Help seeking for some students is not without risk. Help seeking can imply inadequacy and threaten self-worth. Additionally, help seeking implies a social-interactive process (Karabenick & Newman, 2011) that can subject learners to public scrutiny. Being viewed less capable by teachers, other students, or anyone in an evaluative position could be disconcerting—especially for African American students (and other marginalized populations) in mathematics classes with professors who might view them (consciously or unconsciously) as incapable of meaningful participation in mathematics or higher education.

In this country, both historically and presently, Blacks have been thought to be “incapable of having sustained engagement with mathematical thinking, and even less capable of creating mathematical ideas” (Powell, 2012, p. 28). Even the third president of the United States subscribed to this dominant narrative. In his *Notes on the State of Virginia*, Thomas Jefferson (1787) states:

Comparing them [Blacks] by their faculties of memory, reason, and imagination, it appears to me that in memory they are equal to the whites; in reason much inferior, as I think one could scarcely be found capable of tracing and comprehending the investigations of Euclid; and that in imagination they are dull, tasteless, and anomalous. (p. 232)

In 1997, applauding the nearly all-White entering class at the University of Texas Law School, Professor Lino Graglia suggested:

Blacks and Mexican-Americans are not academically competitive with Whites in selective institutions.... It is the result primarily of cultural effects. They have a culture that seems not to encourage achievement. Failure is not looked upon with disgrace. (as cited in Valencia, 2002, p. 90)

For two more recent examples, in 2007, Nobel Laureate James Watson implied that Blacks are inherently less intelligent than Whites, asserting how he was “inherently gloomy about the prospect of Africa” and its inhabitants because “all our social policies are based on the fact that their intelligence is the same as ours—whereas all the tests says not really” (as cited in Nisbett, 2007).

And while addressing the attorney for the University of Texas who was endorsing the schools’ use of race as a consideration for admissions, the late United States Supreme Court Justice, Antonin Scalia, opined:

There are those who contend that it does not benefit African-Americans to get them into the University of Texas where they do not do well, as opposed to having them go to a less-advanced school, a less—a slower-track school where they do well. (as cited in Kopan, 2015)

Scalia goes on to say:

[Black students] come from lesser schools where they do not feel that they’re being pushed ahead in classes that are too fast for them.... I’m just not impressed by the fact that the University of Texas may have fewer. Maybe it ought to have fewer. (as cited in Kopan, 2015)

I reject these disparaging views of African Americans and their mathematical and academic ability and recognize my students’ mathematical brilliance. Today, I hold two degrees

in mathematics (from schools I'd hardly call "slower-track") and have taught mathematics at the local community college where I also served as the program coordinator for developmental studies mathematics. As an African American written off by many of my elementary school mathematics teachers as a problem—thought incapable of learning rigorous mathematics—I know first-hand the feelings of dejection and despair this causes, and I am convinced that it negatively shapes one's "mathematics identity" (Martin, 2000. p. 19) and potentially their academic help-seeking behavior. Furthermore, as a mathematics educator, I understand the importance of mathematics and how it is used in this country, unfortunately, as a gatekeeper to economic success—a tool, that is, to determine who will be successful and who will not (Stinson, 2004). Thus, the purpose of this research study was to understand the factors that may influence the help-seeking behaviors of African American College Algebra students (or mathematics students in general) at the community college, so that community college mathematics instructors can begin the rewarding work of breaking down barriers that may exist between them and their students. When mathematics instructors at the community college (and all learning institutions) realize how much the current policies around post-secondary mathematics education and how much of their current practices inside their mathematics classroom contribute to students' disengagement with the subject, perhaps they will create environments where students feel comfortable asking for help. Perhaps they will begin to create conditions that position their students to successfully complete gatekeeper courses such as College Algebra.

Research Questions

Grounded in self-regulated learning and achievement goal theories, this research utilized the statistical techniques of hierarchical linear modeling (HLM) and multiple regression to investigate factors that influence the help-seeking behaviors of African American students in

their first credit-bearing mathematics class at the community college. Specifically, I investigated the help-seeking practices of African American community college students in the Atlanta Metropolitan and central Georgia² areas who were enrolled in College Algebra. The following research questions, intended to determine how student-level and classroom-level factors might influence help seeking, guided the inquiry:

1. Do different student characteristics (e.g., attitude toward mathematics, the perception of the instructor as supportive, gender, age, enrollment status, or classification) influence help-seeking behaviors?
2. Do classroom characteristics (e.g., collective attitude toward mathematics, the collective perception of the instructor as supportive, or teacher gender) influence help-seeking behaviors?

Significance of the Study

The extant scholarship explores the academic help seeking of adolescent students and university students—with participants that are largely White, Midwesterners enrolled in psychology, chemistry, or computer science classes. With this study, I sought to expand the investigation of academic help seeking from its present emphasis on largely White elementary school, secondary school, and university students to the, often overlooked, community college student who identifies as African American. The students of community colleges are often adult learners who lead different lives than the “traditional” university student. Community college students are likely non-traditional students who work full-time jobs, take care of small children and elderly loved ones, are partners or spouses, or are enrolled in school on a part-time basis

² Though help-seeking behaviors from all community colleges in Georgia may be useful, I have specifically chosen colleges in these areas because of their high population of African American students.

(see, e.g., Kasworm, 2003; Mellow & Heelan, 2014). I must emphasize that it is not my intention to view these students from a deficit perspective. Indeed, these roles could be viewed as assets—through the communal supports they offer and through the life experiences that may help these learners comprehend theoretical constructs that may be entirely intangible to younger learners or those with not as many lived experiences. Conceivably then, in their own right, this population of students and the factors that influence their mathematics help seeking deserves to be researched.

CHAPTER 2

LITERATURE REVIEW

In this chapter, I begin with a discussion of existing scholarship on academic help seeking and offer definitions of what it means to seek instrumental and executive help, while providing an overview of what academic help seeking looks like in grade school, college, and online learning environments. I conclude the chapter with a discussion of two (of many) variables that may influence academic help-seeking behaviors—attitude toward mathematics and professorial concern.

Academic Help Seeking

When students experience difficulty understanding textbook material, solving problems, or completing assignments, they often utilize strategies such as rereading a text more slowly, organizing class notes, reviewing previous examples, or searching for information available on the Internet. If these efforts are ineffective, students may also consult their teachers, classmates, friends, or parents for assistance. For example, young children may ask an adult for help spelling a difficult word. A middle school student, preparing her volcano for the science fair, might ask the teacher for help understanding the type of chemical reaction that takes place when baking soda and vinegar mix. A precalculus student at the community college may appeal to her classmates for the correct solutions to a trigonometric equation. Thus, academic help seeking can be conceptualized as the process of exploring or utilizing resources beyond oneself to obtain information or strategies that will assist in completing a task or solving a problem (Ogan, Walker, Baker, Rodrigo, Soriano, & Castro, 2015).

Until recently, such reliance on others was considered of limited value and even stigmatized, with the criticism that learners who are truly independent are not supposed to need others to succeed (Karabenick & Newman, 2011). This critical view has changed, however.

Recent theoretical developments and research indicate instead that academic help seeking can be an important self-regulated learning strategy, a necessary tool in mature learners' tool boxes (Newman, 2002), and an activity engaged in by highly motivated and academically successful students.

The concept of help seeking might be considerably aided by a distinction between its more negative, traditional characterization as a dependent act and help seeking as a practical and more mastery-oriented activity (Nelson-Le Gall, 1985). These forms of help seeking are termed, respectively, *executive* help seeking and *instrumental* help seeking (Karabenick & Knapp, 1991). A student exhibiting executive (sometimes called excessive or expedient) help seeking is seeking help that avoids effort, is unnecessary, and contributes to dependency. On the contrary, instrumental help seeking expands one's capabilities and improves one's understanding, leading to greater autonomy (Karabenick & Newman, 2011). Hence, instrumental help seeking is considered a useful and adaptive (Newman, 2002) behavior, whereas executive help seeking is self-defeating and maladaptive. According to Newman (2002), one exhibits adaptive help seeking by asking for the help needed so that they can learn independently, not just to get the correct answer. Nadler (1998) makes two similar distinctions between what she calls autonomous and dependent help seeking:

Persons who seek autonomous help are motivated to retain their autonomy, and they use assistance to enable them to achieve on their own. Autonomous help seeking is predicated on the individual's motivation to solve the problem at hand and the belief [that] one is able to do so. Help seeking is a means to an end (i.e., solving the problem on one's own). Not seeking help in this case reflects the person's conviction that he or she does not need outside assistance to solve the problem. (p. 64)

Nadler (1998) goes on to say:

Persons seeking dependent help do so out of passivity and lack of self-efficacy. They are motivated to terminate a painful situation, and they rely on others who they believe can solve the problem for them. Being helped is an end in itself, and the failure to seek help reflects resignation to living with the problem. Persons who engage in dependent help seeking relinquish all their efforts to control their environment and put themselves in the hands of more powerful and knowledgeable others. (p. 64)

Although it is important to encourage learners to seek help, this operative distinction suggests that not all forms of help seeking are equally desirable.

Academic Help Seeking: From Elementary School to College

There have been several studies attempting to understand factors that may influence students' help-seeking behaviors. For example, Ryan and Pintrich (1997) conducted a study to explore how cognitive and social competence, achievement goals, and attitudinal factors explain the help-seeking behavior in early adolescents when it comes to completing their mathematics schoolwork. In their study, students who doubted their cognitive and social ability were more likely to feel threatened when seeking help from their peers and likely to avoid seeking help altogether. This finding was consistent with Newman's (1990) vulnerability hypothesis, suggesting that students with high perceptions of their cognitive competence do not ascribe their need for help to a lack of ability and, thus, are more likely to seek help. In line with Ryan and Pintrich's social competence consideration, the results of their study indicated that adolescents who were comfortable and adept in relating to others were less likely to feel threatened by their peers when asking for help and were, as a result, less likely to avoid seeking help with their mathematics schoolwork. Additionally, Ryan and Pintrich (1997) found that a students'

preference for extrinsic goals and perceived threat were positively correlated with an avoidance of help seeking. Students who reported being extrinsically motivated (e.g., completing math work to keep out of trouble or to get a reward) and unsure of themselves were more likely to report feeling threatened by seeking help and indicated a greater likelihood of avoiding seeking help when they needed it.

In another study involving high school computer science students, Cheong, Pajares, and Oberman (2004) sought to determine the extent to which academic motivation constructs (e.g., computer science self-efficacy, self-concept, achievement goal orientations, etc.) influence the instrumental help seeking, executive help seeking, perceived benefits of help seeking, and avoidance of help seeking after controlling for computer science competence, gender, and race. They found that students with a task goal orientation (i.e., engagement in academic work with the purpose of mastery and seeking challenge) and adaptive behaviors such as instrumental help seeking were positively associated. Additionally, perceived benefits of help seeking and maladaptive behaviors such as executive help seeking were negatively associated. Students with a performance-avoidance goal orientation (i.e., engaging in an academic task with the aim of avoiding showing lack of ability or “looking stupid”) were less likely to exhibit instrumental help-seeking behavior, but rather avoidance of help seeking. Perhaps the most noteworthy findings in Cheong and colleagues’ study were the effects of gender and race on help-seeking behaviors: girls sought more instrumental help and perceived greater benefit of help seeking than boys, and African American students were less likely to avoid seeking help than their White and Asian counterparts. According to the Cheong and colleagues, there were no other studies at the time that reported significant findings based on race.

Other researchers, such as Ames (1992), have explored task goals but not as a student-level characteristic, however. Instead they examine this concept on the classroom level, researching how what is known as the classroom goal structure might influence help seeking. The classroom goal structure is conveyed to students in various ways, including the kinds of academic tasks they are given, how they are recognized and evaluated, and how they are motivated to complete their schoolwork (Ames, 1992). For example, some teachers focus on mastery, improvement, and skill development; others might focus on grades and competition (Meece, Anderman & Anderman, 2006). A classroom where the culture communicates to students that mastery, understanding, and improvement is valued is one with a task-focused goal structure, while a classroom where a student's ability relative to others is valued has a relative-ability goal structure. Ryan, Midgley, and Gheen (1998) sought to understand why some students avoid asking for help and how students' academic efficacy and classroom environment might explain this avoidance. Utilizing a group of 516 sixth-grade mathematics students, they employed hierarchical linear modeling³ to analyze this efficacy–environment interplay. They found that students experiencing a relative-ability classroom goal structure reported more avoidance of help seeking than did students in classroom environments they perceived to be more task focused. Similar to the aforementioned study of high school computer science students, Ryan and colleagues found that boys were more unwilling to seek help with math schoolwork than girls.

Although most of the scholarship on academic help seeking involves adolescent participants, there have been a few studies focusing on college students. For example,

³ Hierarchical linear modeling is a statistical, multilevel regression technique that will be explained in greater detail in Chapter 4 – Methodology.

Karabenick and Knapp (1988) examined the curvilinear (or inverted parabolic-shaped) relationship between the need for academic assistance (measured both by the students' overall expected grade for the term and their self-perceived academic need) and help seeking. The participants were 210 male and 402 female students taking Introductory Psychology at a large midwestern university. They found that the maximum value of the curvilinear function occurred at the B– to C+ grade range. That is, students earning these grades reported the most help seeking. Help seeking increased from A to the B– to the C+ range and then decreased, approaching zero at an expected grade of D. Their research confirmed the casual observation that students who, arguably, need the most help (i.e., those who only expect to earn a grade of D for the semester) are the least likely to seek it. In another study, Karabenick and Knapp (1991) examined the correlates of help seeking among participants from a large state university, a smaller liberal arts college, and a community college collectively. These students were enrolled either in biology, English, or psychology. They found that students who engaged in more achievement-oriented activities were more likely to seek academic help. Alternatively, students who engaged in fewer such activities reported a greater need for academic help. For another example, Karabenick (2004) explored potential predictors of academic help seeking among chemistry students at a large midwestern college, finding that students who were more threatened by help seeking were more likely to avoid seeking academic help and preferred executive rather than instrumental help seeking if they did seek help. Additionally, Karabenick found that students who preferred instrumental help seeking were more inclined to receive this help from a formal source (e.g., a teacher) than from an informal source (e.g., a peer).

Wimer and Levant (2011) provided an intriguing addition to the literature around academic help seeking. Not only did they study college students (as opposed to the adolescent

participants in much of the extant literature), but also they included indicators not present in the aforementioned studies—race and masculinity. Their study included male psychology undergraduates at a mid-sized public university. Of particular interest, nearly 7% of the participants of their study were African American. They found that conformity of masculine norms (i.e., fulfilling societal expectations for what constitutes masculinity in one's public or private life), explained a significant amount of variation in the avoidance of help seeking above and beyond the contribution of demographics, coursework, and inclination for executive help seeking. Unfortunately, their research does not provide a breakdown of avoidance of help seeking by race. Nevertheless, their study provides support for considering gender when exploring academic help-seeking behavior.

Academic Help Seeking in Online Environments

When thinking about academic help seeking it is common that we envision students seeking help from a teacher or a peer, but there are myriad resources beyond the teacher that students can utilize for help. Twenty-first century students increasingly engage with online learning environments. With the rise in the number of distance education (online) classes being offered in mathematics, students in need of help will have to seek other avenues such as email and on-demand tutoring. For some students, these other avenues may even be more preferred compared to more traditional ones. For example, in a study investigating the effects of computer privacy on help seeking, Karabenick and Knapp (1991) divided a group of undergraduate psychology students into two sections—one receiving computer-based help and the other receiving help available only by a research assistant. They found that 86% of the students who had the option to seek private, computer-based help chose to seek help whereas only 36% of the students sought help when the research assistant was the only available source for help. The

researchers suggested that perhaps this marked difference in help seeking could be attributed to the private, computer-based option for help providing students “the freedom to fail without having to suffer the negative social consequences that would result in public displays of inadequacy” (p. 461).

Students typically choose to take classes online because of the convenience and flexibility it offers (e.g., gas and mileage savings, flexibility with work schedules) (McBrien, Cheng, & Jones, 2009; Song, Singleton, Hill, & Koh, 2004). The primary form of communication with online students is email, but, as one might expect, it can be rather difficult to explain, say, the use of synthetic division to find the complex roots of a fifth-degree polynomial with integer coefficients via email. As a more practical alternative to complete their College Algebra assignments, online students might use interactive learning environments (ILEs), which Aleven, Stahl, Schworm, Fischer, and Wallace (2003) refer to as “computer-based instructional systems that offer a task environment and provide support to help novices learn skills or concepts involved in that task” (p. 4). Two popular ILEs in mathematics are Pearson’s MyMathLab[®] and McGraw Hill’s ALEKS.^{®4} These ILEs, among others, provide support for learners in the form of helpful hints and examples, immediate feedback, and opportunities for reflection. My online students use MyMathLab,[®] which also offers author-created instructional videos and interactive applets to help students solve algebra problems. But when these videos are not enough, students are able to seek help from other online tutorial websites. One such example is Khan Academy⁵ an education website that touts an aim to let anyone “learn almost anything—

⁴ For more information about MyMathLab and ALEKS, visit <http://www.pearsonmylabandmastering.com> and <http://www.aleks.com/about-aleks>, respectively.

⁵ For more information about Khan Academy, visit <https://www.khanacademy.org/about>.

for free.” Students, or anyone interested enough to visit the website, can watch over 2,000 videos, where the site’s founder explains principles of mathematics, science, and economics. In a study investigating the online resources students use to help them with learning mathematics, Muir (2014) found that the participants thought Khan Academy was credible and often more effective than a teacher’s or friend’s explanation. Indeed, one student, when asked about the helpfulness of a Khan video about the Pythagorean Theorem, explained, “Yes it was...because with a regular teacher you can’t ask them to repeat...well you can, but it would be disrupting the rest of the class, but you can just play back the video if you don’t understand what’s happening” (p. 844).

Although I did not investigate the help-seeking practices of computer-based, online College Algebra students for this study, I do teach College Algebra online each semester. I find it worthwhile to consider how this new method of instructional delivery might influence help seeking and how it provides different avenues for help seeking than those from decades ago, perhaps in a future study.

Other Predictors of Help-Seeking Behaviors: Perception of the Teacher and Attitudes

Many of the studies about academic help seeking are quantitative in nature and use predictor variables such as student goal orientation, classroom goal structure, and attitudes about help seeking. I aspire to supplement this existing literature by considering two other variables that might influence help-seeking behaviors—perception of the teacher and attitudes toward mathematics—that were assessed through the Professorial Concern subscale of the College

Classroom Environment Scales (CCES) and the Attitudes Towards Mathematics Inventory, respectively.⁶

For some college students, seeking help with their schoolwork really is a tremendous risk—including, but not limited to, chastisement by the instructor or embarrassment in front of their peers. I offer a personal narrative to demonstrate how one of my own college professors contributed to creating a classroom environment that was what one might call hostile or threatening.

Help seeking was certainly a great risk for me while studying mechanics during my freshman year of college. My professor, a brilliant physicist from the West Indies, had a reputation among students and the department as its most difficult professor and the one to stay away from. Typically, I reject such discourse, finding that students often confuse rigor and high expectations for difficulty. Indeed, I have had several professors that my classmates found impossible but that I found agreeable and was able to learn much.

I suppose I could have learned more from my mechanics professor if only I had the courage to ask more questions; the classroom climate just would not allow me. The class performed poorly on the first unit assessment, which involved the concept of vectors. A vector is a quantity in physics that not only has magnitude, but also direction, and is generally denoted in printed text with a boldface letter. When writing a vector quantity, however, it is generally denoted by placing an arrow above the letter; otherwise, one is to assume that the quantity is scalar, rather than vector. It seems like such a simple concept now, especially after completing vector calculus just a few semesters afterward with great success. But at the time, the class just

⁶ These instruments will be discussed in greater detail in Chapter 4 – Methodology.

could not comprehend the concept. I vividly remember my professor scolding the class for this blunder: “It’s as if the lot of you had a meeting and just decided, ‘The hell with the arrow.’”

Now, I grew up around people who used curse words as a part of their everyday vernacular, and blasphemous profanities never bothered me per se; however, I never had a teacher—the person tasked with guiding my intellectual growth and not making me feel small for making mistakes—use such words with me, nor would I have expected it. But I was not a child anymore; I was 18 years old. Perhaps I needed to grow up and develop a thicker skin.

Later in the semester, when we were learning about operations with vectors, the question was asked, “How do we find the inner product?” No one volunteered to answer. Uncomfortable with the awkward silence, I timidly answered, “You multiply it by the cosine of theta.” The professor sharply responded, “What? What is ‘it’? People who say ‘it’ are too damn lazy to say what ‘it’ is.” In hindsight, I could have provided more specificity and detail, but in that moment, I had never been more humiliated or embarrassed in an academic setting. From that day, I made up my mind that I would not be contacting my professor for help and that I simply was not going to comprehend mechanics that semester.

Students were afraid to take the risk of asking (or even answering) questions. It is not my intention to place blame on the instructor for my unsuccessful semester. Arguably, students should take ownership of their education and seek other avenues for help when they struggle, but for me the classroom environment resulted in me checking out completely and becoming totally disengaged with physics. Alas, when I repeated the course during the next semester, my physics identity was severely diminished.

Perceptions of the Teacher's Concern

Much of the empirical work on the classroom context has focused primarily on the classroom learning environment in relation to achievement goal theory of motivation. That is, the scholarship has focused on how certain classroom structures might support different goals (e.g., mastery and performance goals) to become more salient (Ames, 1992). Although there is considerable evidence that the classroom goal structure is important to the understanding of students' help-seeking behaviors, I submit that there may be a host of classroom characteristics and social-interactional variables involving the teacher that play important roles as well, such as students' perceptions of their teacher's concern for students' personal achievement. It is the teacher, in the end, who determines the climate of their classrooms by setting the goal orientation, degree of control and competition, system of rewards, and level of expectations and support for students.

Newman and Schwager (1993), in their study exploring how third-, fifth-, and seventh-grade students' perceptions of their teachers influenced their reported academic help seeking, found that students come to view support from their teachers differently as they develop. Young elementary students perceived a stronger personal relationship with their teacher than did older students; upper elementary and middle school students' perceived stronger encouragement from their teacher for asking questions than did younger children. But most importantly, at all grades, a sense of personal relatedness with the teacher was important in determining who reportedly sought help and who did not (Newman & Schwager, 1993).

In Ryan, Gheen, and Midgley's (1998) study investigating the avoidance of help seeking of middle school mathematics students, they found that low-efficacy students sought help less in classrooms where students perceived a task-focused classroom goal structure. But what was most

interesting about their study is that the teacher's concern about the *social* and *emotional well-being* of the student lessened the relation between efficacy and help avoidance. Hence, the troubling situation where low-efficacy students avoid seeking help more than do their high-efficacy counterparts was ameliorated when teachers were concerned with their students' social-emotional need, suggesting that "warm, supportive relationships empower low-efficacy students to risk asking for help" (p. 533).

Less information about students' perception of the teacher (or professor) has been studied at the collegiate level, largely because of the assumption that college classrooms lack the same interpersonal factors that impact students early in school (Wentzel, 1997); and because of the level of maturity of college students, social factors in the college classroom are less important than they are for younger children (Zusho, Karabenick, Bonney, & Sims, 2007). Another reason that college classrooms have been traditionally overlooked is because of their conventional image—not one of a classroom at all, but rather a large auditorium with a professor giving a lecture, students taking copious amounts of notes, and scarce interaction between students. I believe, however, that perceptions of the person delivering instruction transcend age and that ultimately everyone wants to feel respected and safe should they take the risk of seeking academic help. Using structural equation modeling, Payakachat and colleagues (2013) attempted to identify factors that are associated with the academic help seeking of pharmacy students at a public university. They found that the help-seeking behavior of these aspiring pharmacists was positively related to (among other factors) positive relationships with their faculty members. The results of their analysis indicated that the perception of faculty members as helpful (i.e., respectful, accessible, approachable, and friendly) minimized students' perception of help seeking as threatening and increased help-seeking behavior (Payakachat et al., 2013).

Perceived support of student questioning, one of the components of teacher support, has also been studied at the post-secondary level. Using structural equation modeling with 67 classrooms (classroom was the level of analysis), Karabenick and Sharma (1994) found evidence that students' perceived teacher support of questioning indirectly influenced the likelihood that students would ask questions. Specifically, perceived teacher support directly affected whether students had a question to ask and inversely influenced their inhibition to ask questions—in turn, inversely predicting students' intentions to ask questions. Taken together, college students in classrooms that, mutually, perceived their teachers as more supportive were expected to have more questions, were less repressed to ask them, and hence more likely to ask questions when needed (Karabenick & Sharma, 1994).

William Edward Burghardt Du Bois (1935) once said that the proper education of students “includes sympathetic touch between teacher and pupil...and knowledge on the part of the teacher, not simply of the individual taught, but of his surroundings and background, and the history of his class and group” (p. 328). This statement suggests that even as far back as the 1930s, it was known that teachers matter. Faculty members are, in many ways, the face of the college. They usually teach face-to-face classes and are in contact with students for several hours during the week. When a student graduates, it is likely that she remembers an exceptional faculty member before she remembers other school officials. While it is certainly the case that staff and other school officials are important, faculty members that have positive interactions with their students are the key to student effort (McClenney, 2006).

Attitudes Toward Mathematics

On the first day of class each semester, after thoroughly reviewing the syllabus and establishing my classroom expectations, I ask each student to tell the class something about

themselves—including, but not limited to their name, program of study, careers goals, and expectations for the course. Almost always, students lament: “I can’t stand math,” “Math scares me,” “Math isn’t my strong suit, Mr. China,” “This is my last class; it’s the only thing keeping me from graduating,” or “I don’t understand why I have to take this class. As a culinary arts major, I don’t see how I’m going to use any of this in my career.” Unfortunately, these attitudes are not unique to my classroom. Many students suffer from negative (mathematics) self-efficacy, dispositions toward mathematics, or mathematical identities (see Bandura, 1977, 1986; Martin, 2000). One would think that students who detest mathematics, who are not as strong in the discipline as they might be in others, or who the idea of mathematics even scares, would be the first to seek help. But this is not always the case. In fact, it is rarely the case. Of all college subjects, mathematics is one that stirs up the strongest negative emotions and, in many cases, elicits an attitude of disaffection and even refusal toward the subject (Di Martino & Zan, 2011).

There have been many studies investigating attitudes toward mathematics (see, e.g., Aiken, 1970; Alkhateeb & Mji, 2005; Hodges & Kim, 2013; Lin, 1982; Rech, 1994) and several instruments designed to measure its construct (e.g., Chamberlin, 2010). It should be noted, however, that the construct of “attitude” is not without scholarly contention. Mathematicians and mathematics educators, alike, have always experienced in their own practice the relationship between cognition and emotions, and the part this interplay has on mathematical behaviors (Di Martino & Zan, 2011). Such interplay is known in mathematics education research as *affect*, and it is arguably the most important factor that influences the learning process (Chamberlin, 2010). There is general consensus amongst the mathematics education community in viewing affect as divided into three domains—beliefs, attitudes, and emotions. Agreement, however, is not so unanimous when it comes to defining these constructs (Di Martino & Zan, 2011). Indeed, Kulm

(1980) states, “It is probably not possible to offer a definition of attitude toward mathematics that would be suitable for all situations, and even if one were agreed on, it would probably be too general to be useful” (p. 358).

For this study, however, I used a working definition of “attitude toward mathematics” and defined it as “a measure of students’ positive and negative feelings toward the subject of [algebra] in terms of relevance and value, difficulty and self-efficacy, and general impression toward the subject” (Evans, 2007, p. 24). Moreover, I believe that the Attitudes Toward Mathematics Inventory⁷ (ATMI) (Tapia & Marsh, 2002), an instrument that has been shown to have sound psychometric properties of reliability and validity with college-age respondents, best captures this construct. The ATMI also includes self-confidence, value, enjoyment, and motivation factors that I believe are key to understanding why students seek (or do not seek) help with College Algebra.

Help seeking has been conceptualized as an essential component of self-regulated learning (which will be discussed later and in greater detail). Because self-regulation is an effortful and demanding pursuit, it is expected that students who are more personally interested in a task or activity, who perceive it as more important to them, and who can appreciate its utility are more likely to use self-regulatory strategies, such as adaptive academic help-seeking (Pintrich & Zusho, 2002). Conceivably then, a student’s attitude toward mathematics might influence how and if they go about seeking help when they experience difficulty.

⁷ The Attitude Toward Mathematics Inventory will be discussed in greater detail Chapter 4 – Methodology.

CHAPTER 3

CONCEPTUAL FRAMEWORK

In this chapter, I begin by situating academic help seeking as a self-regulatory activity and provide a detailed overview of the Pintrich Model of Self-Regulated Learning and its phases. I then present achievement goal theory as another logical framework for understanding the reasons why students may (or may not) seek academic help and discuss the implications of performance-avoidance achievement goal orientations for African American students. I conclude by discussing some of the limitations of such frameworks.

Self-Regulated Learning

Pintrich (2000b) stated, self-regulated learning is “an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment” (p. 453). Much of the early scholarship on self-regulation could be described as healing or therapeutic. That is, researchers taught participants how to ameliorate dysfunctional behaviors such as addiction, aggression, and behavior problems (Schunk, 2005). But now scholars apply the principles of self-regulation to academic studying and other forms of knowledge. One of the reasons scholars began studying self-regulated learning in academic settings is that research showed that students’ skills and abilities did not entirely explain achievement (Zimmerman, 2001a, 2001b), which suggested that motivation and self-regulation were also important considerations.

Several studies suggest the following characteristics differentiating students who exhibit self-regulated learning from students who do not (see, e.g., Como, 2001; Weinstein et al., 2000; Zimmerman, 1998, 2000, 2001a, 2001b, 2002):

1. Students are familiar with cognitive strategies (e.g., repetition, elaboration, and organization) and know how to use them to recover information.
2. Students are able to plan, control, and direct their minds toward the achievement of personal goals.
3. Students display motivational beliefs and adaptive emotions (e.g., high academic self-efficacy, positive feelings toward tasks), and the ability to control or modify them based on the requirements of a task and the specific learning context.
4. Students effectively negotiate the time and effort used on tasks, and they know how to create and structure good learning environments (e.g., seeking help from professors and classmates when they have difficulty, finding a suitable place to study).
5. Students show greater effort to influence academic tasks and classroom climate (e.g., how they will be assessed, how work teams will be structured), to the extent that the environment allows it.
6. Students are able to execute volitional strategies, meant to avoid external and internal distractions, to maintain concentration and motivation when performing academic tasks.

Taken together, students who are self-regulated learners view themselves as mediators of their own behavior, believe that learning is a proactive endeavor, are self-driven, and utilize strategies that allow them to achieve their desired academic goals.

The Pintrich Model of Self-Regulated Learning

Pintrich (2000a) believed that self-regulatory activities mediated the relationship between students and their environments and impacted student achievement (Schunk, 2005). In his model, regulatory processes are presented in four phases—planning, self-monitoring, control, and

evaluation. Within each of the four phases, self-regulatory activities are organized into four possible areas—cognitive, motivational/affective, behavioral, and contextual. It should be noted that the model does not dictate that the phases are hierarchically or linearly structured; they may ensue at any time while engaging in a task. In fact, in many models of self-regulated learning, three of the phases—monitoring, control, and reaction—may occur simultaneously, “with the goals and plans being changed or updated on the basis of the feedback from the monitoring, control, and reaction processes” (Pintrich, 2004, p. 389). Additionally, Pintrich specified that not every academic task explicitly involves self-regulation. That is, sometimes there are instances of tasks that do not require a student to strategically plan, control, and evaluate. Instead, the execution of a task may be carried out automatically or implicitly, based on students’ prior experience.

Planning

As displayed in Table 3.1, self-regulation begins with the planning phase, the phase that includes important activities such as setting desired goals or objectives, activating prior knowledge in a purposeful way through self-questioning (e.g., “What do I already know about quadratic equations?”), and metacognitive knowledge (e.g., rehearsal or taking notes, how to implement certain strategies, why and when to use them). In the planning phase, one also sees the activation of motivational beliefs, including goal orientation, self-efficacy, perceptions of ease or difficulty of learning, task value, and interest. A fundamental idea in the Pintrich model, goal orientation, simply refers to the reasons a student might engage (or not) in a task (e.g., why a student wants to pass a course or perform well at a recital). Self-efficacy is a term made popular by Bandura (1986) and refers to students’ beliefs about their own capabilities to do schoolwork. Specifically, it is concerned with “people’s judgments of their capabilities to

organize and execute a course of action required to attain designated types of performances” (p. 391). Students’ ease of learning and perception of task difficulty is concerned with how easy or difficult the student believes course content will be to learn. Task value is concerned with how relevant, important, and useful students perceive the task to be. Interest, which is not to be confused with value, is the degree to which students like the topic being learned.

Table 3.1
Phases of Self-Regulated Learning

Phases	Areas for Regulation			
	Cognition	Motivation/Affect	Behavior	Context
<i>Phase 1</i> Forethought, planning, and activation	Target goal setting	Goal orientation adoption	Time and effort planning	Perceptions of task
	Prior content knowledge activation	Efficacy judgments	Planning for self- observations of behavior	Perceptions of context
	Metacognitive knowledge activation	Perception of task difficulty Task value activation Interest activation		
<i>Phase 2</i> Monitoring	Metacognitive awareness and monitoring of cognition	Awareness and monitoring of motivation an affect	Awareness and monitoring of effort, time use, need for help self-observation of behavior	Monitoring changing task and context conditions
<i>Phase 3</i> Control	Selection and adaptation of cognitive strategies for learning, thinking	Selection and adaptation of strategies for managing, motivation, and effect	Increase/decrease effort Persist, give up help- seeking behavior	Change or leave context
<i>Phase 4</i> Reaction and reflection	Cognitive judgments	Affective reactions	Choice behavior	Evaluation of task Evaluation of context

Note. Adapted from “The Role of Goal Orientation in Self-Regulated Learning,” by Paul R. Pintrich, 2000. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-Regulation*, p. 444.

In this phase, one also finds the self-regulated behaviors, time and effort planning and planning for the self-observation of behavior. Time and effort planning, usually referred to as time management, might include creating a study schedule and allocating time for various activities. Planning for self-observation involves deciding what methods one will use to assess their progress and regulate behaviors (e.g., keeping records of one's word count from day to day as he completes his research prospectus). Finally, in the planning phase, there are contextual regulation factors, which include learners' perceptions of the task and context. These could include perceptions about classroom features that may aid or impede learning, kinds of tasks completed, or classroom climate (Schunk, 2005).

Monitoring

In the monitoring phase are activities that help students become aware of or attentive to their state of cognition, motivation, emotions, time management, and conditions of the task and of the context. Activities related to self-observation of comprehension (or metacognitive awareness) are included here. When a student is aware that she has not fully understood a concept that the teacher just went over, when she is aware that she has read something too quickly or superficially for the depth of text involved, or when she actively observes her own reading comprehension by asking herself questions to gauge whether she has understood, the student is exhibiting metacognitive awareness. Similarly, this phase encompasses motivational monitoring—being aware of one's motivational pattern (e.g., whether one feels competent enough to perform tasks, whether one values a task, or what goals might guide academic behavior). It also includes behavior monitoring—being aware of one's own behavior (e.g., “I have to spend a few more hours during the day writing.” or “I need to get help with my trigonometry homework.”). Contextual monitoring might include task conditions and the

classroom context (e.g., knowing the classroom rules, how students are graded, or teacher behavior).

Control

During the control phase, students attempt to control their cognition, motivation behaviors, and contextual factors based on their monitoring, with the aim of enhancing learning. Cognitive control and regulation includes cognitive and metacognitive strategies that students engage in to adapt and change their cognition. Attempts to control or regulate are related to cognitive monitoring activities that inform the relative difference between a goal and progress toward that goal. For example, when a student reads a mathematics textbook with the goal of actually understanding the material and not just finishing the assignment, then monitoring her comprehension could offer information about the need to change reading strategies. One of the central aspects of the control and regulation of cognition is the selection and use of various cognitive strategies for memory, learning, thinking, reasoning, and problem solving. These cognitive strategies could include the use of imagery (Zimmerman, 1998), mnemonic devices, paraphrasing, and note taking (Weinstein & Mayer, 1986).

Motivational control and regulation include controlling self-efficacy through the use of positive self-talk (e.g., “I know I have what it takes.”) and increasing extrinsic motivation for the task by rewarding oneself after successfully completing the task (e.g., having a glass of wine after completing the second question of, say, a comprehensive examination).

Strategies for behavioral control and regulation include students regulating the time and effort they spend studying based on the monitoring of their behavior and the difficulty of the task (e.g., increasing effort for a task more difficult than originally thought to be). Another behavioral strategy—one particularly important for this study—is help seeking. Studies have shown that

students exhibiting self-regulation know when, why, and from whom to seek help (see, e.g., Karabenick, 1998; Nelson-Le Gall, 1985; Newman, 2002; Ryan & Pintrich, 1997).

Contextual control includes making the context more conducive to learning. A learning-conducive environment might include the elimination or reduction of distractions as well as attempts to renegotiate task requirements. My own students participate in such negotiations often. For example, students might ask me for more time on an assessment if it seems too difficult or for fewer homework problems if the assignment seems too lengthy. And although help seeking is listed as a behavioral strategy (i.e., it involves a student's own behavior), it could also be included under contextual control because it essentially involves seeking help from others in the environment; thus, it is also a social interaction (Ryan & Pintrich, 1997).

Reaction and Reflection

Students' reactions and reflections might include judgments, attributions, and self-evaluations of performance. Upon assessing performance, such assessment forms the basis for other attempts to regulate motivation, behavior, and context (Weiner, 1986; Schunk, 2005). Motivational reactions involve efforts to increase motivation when students determine that their motivation has declined (e.g., attributing low performance to inadequate effort, rather than low ability). These reactions could also involve emotions (e.g., feeling a sense of pride when accomplishing a task, feeling sad when failing). Just as students can make judgments or reflect on their cognitive processing and motivation, they can also make judgments about their behaviors. Students may decide that procrastinating studying for a test may not be the most adaptive behavior for academic success. Thus, they might decide to make a different choice in terms of their effort and time management in the future. Regarding contextual reaction and reflection, students can make general evaluations of the task or classroom environment. These

assessments can be made on the basis of general enjoyment and comfort, and also cognitive criteria regarding learning and achievement. In some classrooms that are more student centered, there is even time devoted for occasional reflection on what is effective and what is not effective in the classroom with respect to student and teacher reactions (Pintrich, 2000a).

Achievement Goals and Help Seeking

The Pintrich model (2000b) was a major contribution to the understanding of self-regulated learning, but Pintrich also contributed to this area through his emphasis on the importance of motivational processes and students' goal orientations to self-regulation, thus allowing for another conceptual framework for which to situate academic help seeking—achievement goal theory. To begin the discussion on achievement goal theory and how it mediates help seeking, one might consider the following questions:

1. Why do students ask for help with their schoolwork?
2. Why do students avoid asking for help with their schoolwork?
3. Why do students avoid asking for help, even when doing so may alleviate real distress?

Attempts to answer these questions have been led by achievement goal theory and the idea that students are willing (or reluctant) to ask for help depending on what it is they are striving to achieve (i.e., their construction of the goals and purposes of learning). Nicholls (1984) distinguished between two kinds of motivational states or goal orientations. In the first, which he calls *ego involvement*, students aim to maintain their self-worth by showing superior ability or by trying to hide inferior ability. They get satisfaction from performing better than others. In the second, which he calls *task involvement*, and which has similarities with intrinsic motivation, students strive to acquire worthwhile skills and understandings and derive satisfaction from

learning and acquiring competence. Dweck (1986) made a similar distinction between what she called *performance goals* and *learning goals*. In the one, students are focused on issues of ability, whereas in the other, students are focused on effort “as a means of utilizing or activating their ability, of surmounting obstacles, and of increasing their ability” (p. 4). Additional distinctions such as mastery and relative ability have also been adopted (see, e.g., Ames, 1992; Pintrich, 2000; Murphy & Alexander, 2000). But whether the researcher uses the labels mastery, task involved, or learning goals, all three labels represent a general goal of improving competence. Similarly, whether we use the labels performance, ego-involved, or relative ability, all three labels represent the general goal of demonstrating competence and outperforming others. And although there may be subtle differences between the theories behind the different labels, *mastery* and *performance* are the most commonly used terms in contemporary achievement goal theory (Pintrich, Conley, & Kempler, 2003).

It should be noted that achievement goals and goal orientations might be different from other goal constructs. Indeed, they are more specific to achievement tasks than broader life goals, such as, say, happiness, love, friendship, or wealth (Pintrich et al., 2003). Goal orientations are even broader constructs than specific target goals for a task—goals that are the particular results or ends that an individual wants to achieve (e.g., get no less than a 700 on the GRE). Thus, achievement goal orientations are constructs that lie somewhere in the middle between specific target goals and more general life goals. As Pintrich and colleagues (2003) explained:

Achievement goal orientations represent the individual’s “orientation” to the task or situation, their general focus or purpose for achievement, and not just the specific target goal they have for the task. In this sense of achievement goal orientations, the construct may include the general focus or purpose for achievement, such as mastery or

performance, as well as the standards or criteria that individuals may use to define their goals.... In this definition, mastery goals reflect a focus on developing competence, learning, and understanding the task and the use of self-referenced standards of improvement. Performance goals reflect an orientation to demonstrating competence, being superior to others, and the use of social comparative or normative standards. This goal orientation is more narrowly focused on achievement than general life goals, but broader than specific target goals for achievement tasks. (p. 3)

Students' personal motivations for engaging in schoolwork may differ, but researchers of achievement goal theory suggest that the extent to which students pursue goals in any context is influenced by the degree to which the situation calls for learning and acquiring competence in order to demonstrate superior ability (Butler, 2011). Conceivably then, it appears that achievement goal theory could provide a viable framework for conceptualizing motives both to seek and to avoid help and for predicting when students will be more likely to resolve the help-seeking dilemma by seeking or by avoiding necessary help.

Performance and Mastery Goal Orientations

Although some of the research has been experimental (Senko et al., 2011), the majority of the research on mastery and performance goals has been done in the classroom by comparing students' self-reported goals and perceptions of their classroom goal structure with various educational outcomes, including course/exam grades, interest in the course content, self-regulation, and academic help seeking (Pintrich et al., 2003). Generally, outcomes for mastery goals tend to be consistent and mostly favorable. Students who strive for mastery goals, compared to those who do not, typically show interest in their classes, demonstrate persistence when facing difficulty, seek academic help when confused, self-regulate effectively, and

recognize tasks as valuable (Pintrich et al., 2003). Karabenick (2004) conducted a study of relatively high-achieving chemistry students enrolled at a large midwestern university to explore the associations between their help-seeking behaviors and their perceptions of their classes' achievement goal structure. This study was particularly interesting because it used both students' personal achievement goals and their perceptions of the classroom goal structure. The results of the study indicated that students' perception of the classroom goal structure predicted students' help-seeking behaviors, even after controlling for differences in their personal goal orientations. For personal goals, students who perceived their classroom environment as encouraging learning and promoting mastery were more willing to ask for help when they needed it and less likely to avoid seeking help (Karabenick, 2004).

It is important to recognize that researchers have proposed that aiming to demonstrate superior ability and aiming to avoid the demonstration of inferior ability describes two distinct goal orientations—performance-approach and performance-avoidance, respectively (Butler, 2011). For example, Elliot (1999) posited that students could be positively motivated to try to perform better than others and demonstrate their superiority and competence, thus displaying an approach orientation to the performance goal. On the other hand, students can be negatively motivated to avoid failure or avoid looking incompetent or dumb, thus displaying what Elliot called an avoidance orientation to the general performance goal. For clarity, Elliot explained:

Approach and avoidance motivation differ as a function of valence: In approach motivation, behavior is instigated or directed by a positive or desirable event or possibility, whereas in avoidance motivation, behavior is instigated or directed by a negative or undesirable event or possibility. (p. 170).

This approach–avoidance distinction is not limited to the performance goal. Indeed, mastery goals have also been divided into mastery-approach and mastery-avoidance goals (Elliot 1999; Pintrich 2000a). A student demonstrates a mastery-approach goal orientation when she strives to learn or improve her skills, whereas the student demonstrates a mastery-avoidance goal orientation when she strives to avoid learning failures or ability decline (Senko, Hulleman, & Harackiewicz, 2011). The findings for the two avoidance goals, however, have been almost consistently negative, being associated with high anxiety, poor study habits and performance, avoidance of help seeking, low self-efficacy, and disengagement (see, e.g., VanYperen, 2003; Elliot & Church, 1997; Wolters, 2004). Table 3.2 provides illustrative examples of the approach/avoidance dichotomy.

Table 3.2
Mastery- and Performance-Approach/Avoidance Scenarios

Goal Orientation	Approach	Avoidance
Mastery	Francina loves for her closets to look clean and organized, and they would be if it weren't for those darned fitted sheets. To keep her closets pristine, she goes on YouTube and learns to master the art of folding fitting sheets. Her closets never looked better.	Allison studied mathematics while in college at Wellesley. As a developmental educator, she's spent the past 10 years teaching lower-level math classes such as College Algebra and Precalculus and is slowly starting to forget some of the advanced mathematics she learned as an undergrad. To keep from getting rusty, she works three Calculus problems each week during her planning period.
Performance	Autumn is taking an advanced graph theory course in graduate school and really wants to be a part of a study group she's eyeing, but the group is not really sure of her ability. Some doubt she should even be taking the class. To prove herself, she sits on the front row and tries to be the first person to answer the professor's lecture questions.	Jamar, a 6'2'', 250-lb man, has been invited to the Three Dollar Café to watch football with "the guys." But he's a fraud! Knowing absolutely nothing about football, and not wanting to look stupid before these men who exude masculinity, he visits Wikipedia to brush up on the sport. He's even more confused.

Performance-Avoidance Goal Orientation: Implications for African American Students

Goals are typically situation-specific and have often been studied and examined within specific domains—most notably the achievement domain, where researchers focus on different variations of competence-relevant motives for behaviors. As mentioned earlier, achievement goals can be understood in two major distinctions, approach and avoidance. Particularly, a performance-avoidance goal orientation involves avoiding the demonstration of inferior ability relative to others. In this section, I submit that the performance avoidance goal orientation has an added layer of complexity for African American students (and other marginalized student populations, e.g., women in mathematics) when we consider race and stereotypes. I offer a personal example.

My sister, a brilliant mathematician and Associate Professor of Mathematics at a large community college in the South, was sharing with me how, despite incessant pleas for her Calculus students to seek tutoring, the students simply wouldn't—until the day before their test, which isn't of much benefit at that point. Familiar with the focus of my research, I said, teasingly, “Maybe you and the folk at the tutoring center just aren't approachable.” She laughed and we continued brainstorming why students who seem to need the most help are reluctant to seek it and what things we can do to make it easier for them to seek help. We found ourselves reminiscing about our swiftly past college days and how we went about seeking help when we needed it. My sister explained how in graduate school she was afraid to take the risk of seeking help, even from her “most approachable” mathematics professor. For her, it seemed as though the content she had questions about, her smart Asian and White classmates already understood and as “the Black girl from the Black college” she didn't want her professor (or classmates for that matter) to be justified in their presumption that “Black students always need help,” “this

Black student doesn't belong here," or "students aren't *really* learning mathematics at those Black colleges."

Considering the incendiary remarks from President Thomas Jefferson, Nobel Laureate James Watson, Law Professor Lino Graglia, and the late Supreme Court Justice Antonin Scalia about the intellectual and mathematical inability of Black students (recall the discussion from Chapter 1), it is not surprising how my sister could have arrived at this assumption about her mathematics professor and classmates. What she was experiencing, being afraid to ask for help out of fear of confirming some negative belief about people of her race is what Steele (2003) refers to as *stereotype threat*, "the threat of being viewed through the lens of a negative stereotype, or the fear of doing something that would inadvertently confirm that stereotype" (p. 121). As Steele and Aronson (1995) explained:

[This predicament] focuses on a social-psychological predicament that can arise from widely-known negative stereotypes about one's group. It is this: the existence of such a stereotype means that anything one does or any of one's features that conform to it make the stereotype more plausible as a self-characterization in the eyes of others, and perhaps even in one's own eyes. (p. 797)

Steele and Aronson (1995) attempted to unearth, through a series of experiments with college students, the effects of stereotype threat on academic performance. In one experiment they brought White and Black sophomores of equal ability into a laboratory and administer to them the Graduate Record Examination (GRE) subject test in English literature. As a significant part of the negative stereotype about Blacks concerns intellectual ability, the participants were told that the exam is meant to measure their verbal ability. The results revealed that the Black students performed a full standard deviation below the White students while under the stereotype

threat of the test being diagnostic of their ability, despite being statistically matched in ability level.

When the test was administered again, this time presented as a laboratory task used to study how certain problems are solved and heavily stressed that the task does not measure ability, the Black students' performance rose to match that of equally qualified White students. Transcending race, similar results were found with a group of freshmen women and men. These students were given a difficult GRE mathematics subjects test. Under the stereotype threat that women do not perform as well in mathematics as their male counterparts, the women scored significantly lower than the men. When this threat was removed, however, they performed just as well.

In summary, stereotype threat should be a consideration when discussing the performance-avoidance goal orientation that African American (and other underserved groups) students adopt. Students adopting such goal orientations want to avoid the appearance of intellectual inferiority or looking stupid in front of their peers or teachers. But they may also carry with them the extra burden of apprehensions of failing their race (or group) or the risk of confirming negative stereotypes about their race. There have been numerous studies on the idea of stereotype threat and academic *achievement* (see, e.g., Aronson et al., 1999; Cadaret et al., 2017; Johns, Schmader, & Martens, 2005), but none on its effects on academic *help seeking*. Perhaps future research on stereotype threat might include this consideration.

Limitations of Self-Regulated Learning and Achievement Goal Theories

Although self-regulated learning and achievement goal theories provide a sound framework to situate academic help seeking, they are not without limitations. First scholars (Pintrich, 2000a, 2000b; Schunk, 2005) call for more cross-cultural research and research with

ethnically diverse populations. As Pintrich (2000b) indicated, “The emphasis on the individual and the self is certainly paramount in models of self-regulation” (p. 493). North American values, however, are not necessarily prevalent in non-Western cultures; thus, research on self-regulation may not be generalizable. The relationship between goal orientations and self-regulation outcomes might differ among cultures—notably African American cultures. Though African Americans may have adopted many Western values, some African Americans thrive in cooperative learning settings where information can be shared and help seeking is encouraged (see, e.g., Haynes & Gebreyesus, 1992; Nieto & Bode, 2012). From a practical perspective, this issue is important. With the increase of African American, Latino/a, and Asian American students in American K–16 schools and colleges, it is necessary that teachers understand and appreciate the cultural and ethnic differences of their students to improve their self-regulatory capacities.

In regards to achievement goal theory, some students’ motives for seeking (or not seeking) help do not necessarily fall into the two distinct categories: benefits for learning and threats to self-esteem (Butler, 1998). Instead, students might choose to seek help out of a desire to succeed, evade the embarrassment that erring may cause, or speed up task completion. On the other hand, students might be reluctant to seek help because they may perceive their teachers as not receptive to students asking questions or that their teachers might respond in such a way that embarrasses them or requires that they exert more effort than they are willing to exert (Butler, 1998). Not only might students avoid seeking help out of the fear of appearing stupid but also they might avoid seeking help out of a desire to work things out for themselves or out of the perception that asking for help is simply too much bother. For example, Wimer and Levant (2011) in a study of college men, found a significant relationship between all of self-reliance,

dominance, power over women, and emotional control and the avoidance of help seeking—self-reliance being the most strongly correlated. For a final example, van der Meij (1988) found that elementary school students avoided seeking help because of their strivings for independent mastery and not to masking lack of ability.

CHAPTER 4

METHODOLOGY

In this chapter, I provide an overview of hierarchical linear modeling (HLM) and explain how such models are built and conclude by highlighting some of the limitations and shortfalls of HLM. I begin the chapter with a restatement of both the purpose and the research questions that guided the inquiry.

This study investigated factors that influence the help-seeking behaviors of students in their first credit-bearing mathematics class at the community college. Specifically, I investigated the help-seeking practices of African American community college students in the Atlanta Metropolitan and central Georgia⁸ areas who were enrolled in College Algebra. Two questions, explored through HLM, guided the inquiry:

1. Do different student characteristics (e.g., attitude toward mathematics, the perception of the instructor as supportive, gender, age, enrollment status, or classification) influence help-seeking behaviors?
2. Do classroom characteristics (e.g., collective attitude toward mathematics, the collective perception of the instructor as supportive, or teacher gender) influence help-seeking behaviors?

What is Hierarchical Linear Modeling?

There are many names for hierarchical linear models. In sociology research, they may be called multilevel linear models, whereas in applications of biometry, the terms mixed-effects and random-effects models are commonly used (Raudenbush & Bryk, 2002). Such models are even

⁸ Though help-seeking behaviors from all community colleges in Georgia may be useful, I have specifically chosen colleges in these areas because of their high population of African American students.

called random-coefficient regression models and covariance components models in other literature. However, Raudenbush and Bryk (2002) have espoused the term hierarchical linear models because it captures the important structural feature of data that is so prevalent in social research. Using their nomenclature, HLM combines the strengths of regression and ANCOVA (analysis of covariance) designs by allowing researchers to predict outcome scores with other continuous or non-continuous variables while taking into account the fact that the scores may be nested within groups.

In the social sciences, data structures are often hierarchical in the sense that there are variables that describe individuals, who are nested into larger groups—each group composed of a number of individuals. Moreover, there are variables that describe these higher-order groups (Raudenbush & Bryk, 2002). This type of structure is especially present in education. Students are generally grouped in classes. There are variables describing the student (e.g., age, race, gender, etc.), and there are variables describing the classroom (e.g., size, classroom goal structure, location, etc.). To further illustrate the hierarchical structures found in education, consider elementary age students grouped in classrooms. These classrooms are grouped within schools, and the schools are grouped within school districts. Thus, HLM allows us to determine which schools differ and *why* they may differ.

Benefits of Hierarchical Linear Modeling

Even with the dominance of hierarchical structures in the social sciences, Raudenbush and Bryk (2002) suggested that past research studies have time and again failed to attend to them sufficiently—often ignoring the aforementioned nested structures. Neglecting these structures may lead one to inaccurate conclusions because of biased standard errors (as will be discussed

later), and thereby potentially create education policy based on bad mathematics (Koretz, 2009).

Let us first consider the issue of statistical dependency.

A key assumption in an ordinary least squares model (and other traditional statistical analysis techniques) is that each individual contributes a unique piece of information that is unrelated to information contributed by other members of the sample (O'Dwyer & Parker, 2014). With nested groups, however, this assumption is violated. For example, it is likely that students who attend the same school are more similar to each other than to students from other schools (e.g., they come from the same communities, have the same teachers, use the same school resources, etc.), and thus statistical dependency occurs. Additionally, when group-level characteristics are used to predict individual outcomes, statistical dependency may occur (O'Dwyer & Parker, 2014). For example, suppose a researcher (like myself) is interested in the relationship between a classroom's collective perception of the environment and the help-seeking behaviors of the students. Each student in the classroom is assigned the same value for a group characteristic, also leading to statistical dependency.

Now consider this scenario: Suppose I was a researcher interested in English achievement among students attending schools in Texas. Simply performing an ANOVA to examine differences between mean English achievement scores across schools would paint an incomplete picture. It would not take into account that some of the schools closer to the U.S.-Mexico border might have a larger number of students who do not speak English or whom English is not their first language. Ignoring this structure might lead the researcher to the conclusion that a school is doing a poor job of educating its students in English, when in reality they may be doing a fine job teaching English—with respect to the population of students in their school.

Upon the importance of considering the hierarchical structure that data may contain, the researcher must address how and what statistical techniques should be used to take into account such a structure. One way is to disaggregate each higher-order variable to the individual level. That is, school and classroom characteristics to the individual student, and perform the analysis on the student level. Raudenbush and Bryk (2002), however, suggested this approach is problematic because students who are in the same classroom will have the same value on each of the classroom variables. Hence the assumption of independence of observations—one of the most basic assumptions of conventional statistical techniques—will have been violated.

Another, somewhat discredited, option is to aggregate student characteristics over classrooms and perform a classroom analysis, possibly weighted by the size of the classroom. The problem with this option, according to Raudenbush and Bryk (2002), is that we discard all of the within-group information—likely as much as 80% to 90% of the total variation before one even starts the analysis (p. xx). Consequently, the relationships between aggregated variables are typically far stronger and can be much different from the relationships between nanoaggregate variables (Raudenbush and Bryk). Hence, if one attempts to interpret the aggregate analysis on the student level, one risks wasting information and distorting interpretation; aggregation and disaggregation are both inadequate. Fortunately, HLM permits researchers to arrive at a group of models that account for hierarchical structure and that allow the incorporation of variables from all levels. Through the use of hierarchical linear models, each level of a structure is formally represented by its own sub-model—sub-models that represent the relationships between variables within a specified level, and show how variables at one level influence relations at another level. Additionally, if there are more levels, then there are more nested sub-models.

How a Hierarchical Linear Model is Constructed

Before I explain the model-building procedure, it may be useful to provide some definitions of commonly used terms.

Level of Hierarchical Data Structure

As mentioned earlier, data structures are often hierarchical in the sense that there are variables that describe individuals, and the individuals are also nested into larger groups—each group composed of a number of individuals. Each group level is numbered in ascending order, starting with the most basic level. The levels describe the nesting within the hierarchy and accordingly the sources of random variation and covariation to be modeled. For example, in a two-level school effects model, individual students would be considered level-1 and school would be considered level-2. The levels are defined by assigning level-1 with the subscript i and level-2 with the subscript j . If the researcher was interested in exploring classroom effects, the model would then be a three-level model with individual students at level-1, classroom at level-2, and schools at level-3 (see Figure 1), The levels would then be defined by assigning level-1 with the subscript i , level-2 with the subscript j , and level-3 with the subscript k . Subsequent levels are simply assigned ascending letters in the alphabet (e.g., k, l, m).

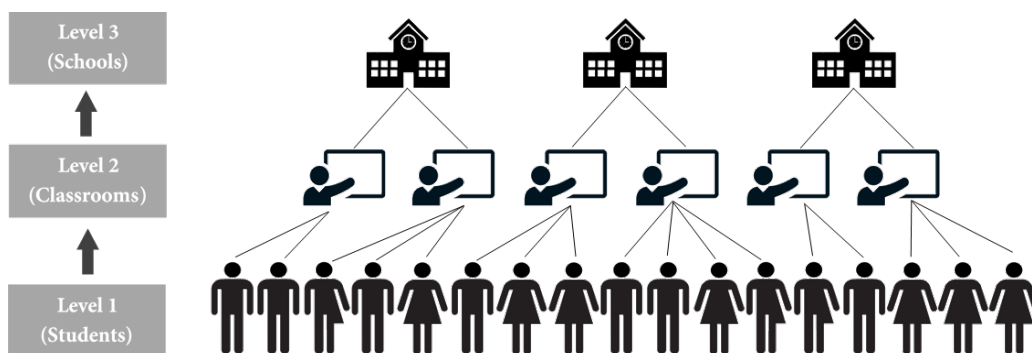


Figure 4.1. Network graph depicting three-level nested structure/hierarchy.

Fixed and Random Coefficients

The results of a hierarchical analysis are a set of coefficient estimates that are interpreted similarly to how one interprets the results from an ordinary least squares (OLS) analysis. The difference between the interpretation of the parameter estimates for the OLS and HLM is that the latter has additional estimates of the variances and covariances of the measurements that reflect the hierarchical structure. The notion of fixed and random coefficients refers to the variation in such coefficients for the regression model (Roberts, 2004). Consider the following heuristic example: Suppose a researcher wishes to investigate the effects of help seeking on mathematics achievement scores. In the OLS model, only one error term describes the variability of the students' actual achievement scores from their predicted achievement scores given their reported levels of help seeking. Roberts (2004) suggested that this model might not be appropriate, considering the between-student differences in achievement scores within schools.

Contrary to the OLS model, one includes additional error terms in the hierarchical linear model to reflect the pattern of variation provided by the hierarchical structure. The coefficient for the slope of the variable "help seeking" is an average of the effect of this variable over all schools; one calls this the "fixed effect" of help seeking. The coefficient of help seeking can also include a random term which signifies that the effect of a student's reported help seeking is allowed to differ over schools (i.e., each school is permitted to have its own estimate instead of having just a single estimate for the entire dataset). The addition of a random term for help seeking suggests the possibility that students within schools may be more alike than students in different schools. Thus, if help seeking is a predictor variable in the previously described HLM, the coefficient for help seeking may need to allow for a random effect, because a student who reports low help seeking from a school where overall help seeking is low, may have a different

effect on mathematics achievement scores than a student who reports low help seeking in a school where overall help seeking is high.

Intraclass Correlation Coefficient

As its name suggests, the intraclass correlation coefficient can be viewed as a measure of the correlation between (intra) groups (class). More formally, it is a measure of the proportion of variance in the dependent variable, say, mathematics help seeking, that is between groups (i.e., level-2 units, say, College Algebra classrooms). The intraclass correlation (ICC) is sometimes referred to as the cluster effect—a term that makes more sense after reading Hox’s (1995) explanation that the intraclass correlation is a “population estimate of the variance explained by the grouping structure” (p. 14). In a two-level HLM, the intraclass correlation coefficient, ρ , is calculated using the formula

$$\rho = \frac{\tau_{00}}{\sigma^2 + \tau_{00}}, \quad (1)$$

where τ_{00} represents the level-2 intercept variance and σ^2 represents the level-1 intercept variance. Equation (1) shows that ICC is the proportion of the group-level intercept variance (the numerator) from the total variance (the sum of variances in the denominator).

The concept of intraclass correlation is particularly important; if it exists, the conventional linear model would not be appropriate, as the assumption of independence of observations would be violated (Roberts, 2004). Another reason why intraclass correlation is an important consideration can be understood with the following scenario: Suppose a researcher is interested in mathematics achievement and has collected data from schools that are urban, suburban, and rural. A traditional ordinary least squares (OLS) model would neglect intraclass correlation and the prediction of mathematics achievement scores would be approximated

regardless of the type of school the student attends. But perhaps mathematics achievement is not independent of school context. That is, students' scores might be, in part, a function of the school that they attend—where students attending the same school may be more alike than students in different schools. This occurrence would cause more dependency of observations and, consequently, a high intraclass correlation (Roberts, 2002).

Participants and Instruments

Participants

The participants for this study came from several community (or technical) colleges in the Metropolitan Atlanta and central Georgia areas—colleges that are majority Black institutions. All survey instruments were administered to the participants electronically via Qualtrics, a tool that allows researchers to create and distribute surveys and analyze the results (Qualtrics 2017). After contacting the Director of Planning, Research, and Policy Analysis at the Technical College of Georgia, I received a list of roughly 40,000 student email addresses. Using Qualtrics, I sent emails to each student invited them to participate in the research study.

Attitudes Toward Mathematics

For nearly four decades, researchers have been interested in studying students and their beliefs and attitudes toward mathematics. Fennema and Sherman (1976), best known for the creation of the Fennema-Sherman Mathematics Attitude Scales, are perhaps the foremost scholars in this line of research. As a part of a grant from the National Science Foundation, these scales were originally designed to gain more information concerning how high school female students learn mathematics and how they navigate the election of mathematics courses (Fennema & Sherman, 1976). The instrument consists of nine scales that can be used as a group, independently, or in any desired combination: (1) The Attitude toward Success in Mathematics

Scale, (2) The Mathematics as a Male Domain Scale, (3) The Mother Scale, (4) The Father Scale, (5) The Teacher Scale, (6) The Confidence in Learning Mathematics Scale, (7) The Mathematics Anxiety Scale, (8) The Effectance Motivation Scale in Mathematics, and (9) The Mathematics Usefulness Scale (Fennema & Sherman, 1976). Adapted versions of the scales are used widely in education research (see, e.g., Ren, Green, & Smith, 2016; Forgasz, Leder, & Gardner, 1999; Yee, 2010). The scale has even been modified to capture Turkish students' attitudes toward learning with technology (see Kahveci, 2010).

Other researchers have also developed instruments aimed at investigating attitudes toward mathematics. Tapia (1996) created a 40-item instrument to measure mathematics attitudes called the Attitude Toward Mathematics Inventory (ATMI) utilizing a sample of 544 high school students in Mexico City. After dropping the nine weakest items in the instrument, the Cronbach alpha coefficient increased from 0.96 to 0.97, revealing sound reliability and internal consistency. The results of a principal components factor analysis indicated four factors: (1) students' sense of security, (2) value of mathematics, (3) motivation, and (4) enjoyment of mathematics (Tapia, 1996). But because the ATMI was created using high school students, further analysis was needed to know if these four factors would maintain for college students. Additionally, the ATMI was developed using a largely Hispanic sample, allowing for the possibility of a different factor structure for an American sample. To address these issues, Tapia and Marsh (2002), performed confirmatory factor analysis to determine if the previously identified four-factor model would hold up for college-aged American students. Using several measures (e.g., chi-square goodness of fit, the ratio of the chi-square goodness of fit to the degrees of freedom, the root mean square error approximation, the normed fit index, and the

expected cross-validation index) to assess model fit, they found that the four factors, indeed, hold up for college-age respondents, $\chi^2(2, N = 134) = 2.834, p > 0.05$ (Tapia & Marsh, 2002).

To measure attitudes toward mathematics, I administered the ATMI—primarily because of its reliability and validity with college-age respondents, but also because of the self-confidence, value, enjoyment, and motivation factors which I believe are key to understanding why students seek (or do not seek) help with College Algebra.

The format for all items in the inventory is a 5-point scale, ranging from 1 = *strongly disagree* through 5 = *strongly agree*. Examples of items in the original inventory include, “Mathematics does not scare me at all,” “Mathematics courses will be very helpful no matter what I decide to study,” “I have usually enjoyed studying mathematics in school,” and “I plan to take as much mathematics as I can during my education” (Tapia & Marsh, 2002).

Classroom Environment: Perceptions of the Teacher as Supportive

There have been several historically important and contemporary survey instruments used to assess classroom environments—ranging from the Learning Environment Inventory developed and validated in the 1960s (Fraser, 1982) to the College and University Classroom Environment Inventory (Fraser et al., 1986), to the What is Happening In This Class Questionnaire (Chionh & Fraser, 1998). Though there is some notable previous work focusing on the school-level environment in colleges and universities, there is not much on college classrooms paralleling the traditions of classroom environment research at K–12 schools. Consequently, Winston, Vahala, Nichols, and Gillis (1994) developed an instrument, the College Classroom Environment Scales (CCES) (Winston, Vahala, Nichols, & Gillis, 1988, 1989) to assess the social climate of college classrooms. The CCES was developed in two phases. The original instrument, developed in 1988, contained 143 items administered to students at both a

small and a large university in the Southeast. Items were removed if they duplicated other factors or correlated negatively with other factors. Their factor analysis resulted in the elimination of 52 items. During the second phase, the authors began a second data collection using the remaining 91 items. A second factor analysis resulted in the elimination of an additional 29 items. Thus, the final version of CCES, completed in 1989, contains 62 items where participants can answer: 1 = *Never or almost never true*, 2 = *Seldom true*, 3 = *Occasionally true*, 4 = *Often true*, or 5 = *Always or almost always true*.

The CCES comprises six scales that can be utilized independently. These scales include Cathetic Learning Climate, Professorial Concern, Inimical Ambience, Academic Rigor, Affiliation, and Structure. Given that the scales can be used independently and because this study focused on students' perceptions of a supportive teacher, I employed the Professorial Concern (12 items) scale. Using coefficient alphas, the scales for the survey instrument were found to be reliable measures of students' perception of the classroom social environment, with coefficients 0.89 and 0.73 for the Professorial Concern and Inimical Ambience scales, respectively.

According to Winston and colleagues (1994), high scores on the Inimical Ambience scale characterize an environment that students see as being hostile, highly competitive, and rigidly structured. Expectations and evaluation criteria are perceived as unclear. Authority is seen as arbitrary and as exercised in a depersonalizing and aggressive manner. Students are uninvolved in classroom activities, see few visible opportunities to influence the classroom process, and are uncomfortable asking questions. A sample item from this scale is "The professor is impatient when someone says something 'stupid' or asks 'dumb questions.'"

As for the Professorial Concern scale, high scores on it describe an academic environment where students perceive the instructor as being personally concerned about them as

individuals and as striving to foster their education and personal achievement. The instructor is perceived as being friendly, caring, and open—as showing empathy in her (or his) interactions, and as respecting students’ ideas.

Help-seeking Behaviors: The College Algebra Help Seeking Scales (CAHSS)

Cheong, Pajares, and Oberman (2004) created the Computer Science Help Seeking Scales (CSHSS) to determine the relationship between academic motivation and the help-seeking behaviors of computer science students. The CSHSS consisted of several subscales, and for the purpose of this study, I focused on three: Instrumental Help Seeking, Executive Help Seeking, and Avoidance of Help Seeking. Items on these scales are rated on an eight-point Likert-type scale with responses ranging from 1 = *Most definitely false* to 8 = *Most definitely true*. Higher scores indicate higher instrumental, executive, and avoidance of help seeking. Pajares and colleagues (2004) found high Cronbach coefficient alphas of 0.89, 0.92, and 0.86 for the Instrumental, Executive, and Avoidance of Help Seeking scales, respectively. Wimer and Levant (2011) used a modified version of these same scales for psychology students ranging from 0.90 to 0.94. Taken together, the CCHSS was found to be a reliable instrument. After exploratory factor analysis, evidence was found for construct validity of the scales (Pajares et al., 2004).

The Instrumental Help Seeking subscale contained a total of 10 items, with half of them meant to assess seeking help from the teacher, and the other half meant to assess seeking help from peers. A sample item is: “When I ask my teacher for help understanding the material in this class, I prefer the teacher help me understand the general ideas rather than simply tell me the answer.” The Executive Help Seeking subscale also contained 10 items, with half of them meant to assess seeking help from the teacher, and the other half meant to assess seeking help from peers. A sample item is: “When I ask the teacher for help in this class, I prefer that the teacher do

the work for me rather than explain to me how to do it.” Last, the Avoidance of Help Seeking subscale contained 9 items modified from other existing scales. A sample item is: “If I need help to do a computer science problem, I prefer to skip it rather than to ask for help.”

Pajares and colleagues (2004) indicate that the help seeking scales in their study could be readily modified to use in other academic areas. Consequently, in this study, I utilized a modified version of the CSHSS, which I call the *College Algebra Help Seeking Scales* (CAHSS). The wording was adapted to fit a College Algebra context. For example, the item “When I ask a student for help with my computer science work, I don’t want that student to give away the whole answer” was changed to “When I ask a student for help with my College Algebra work, I don’t want that student to give away the whole answer.”

Model for the Present Study

Using a step-up approach, the commonly used approach in HLM literature (Raudenbush & Bryk, 2002), I created a model to examine the influences on Instrumental, Executive, and Avoidance of Help Seeking. The final model (explained in greater detail in the next chapter) is presented below. At level-1 (student-level), the equation is given by

$$\text{Avoidance}_{ij} = \beta_{0j} + \beta_{1j}\text{Attitude}_{ij} + \beta_{2j}\text{ProfConcern}_{ij} + \beta_{3j}\text{Age}_{ij} + \beta_{4j}\text{StudentFemale} + r_{ij},$$

and at level-2, the equation is

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\text{TeacherFemale} + \gamma_{02}\text{AverageAge} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}\text{TeacherFemale}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}.$$

The variable Avoidance_{ij} is the outcome variable and will represent the predicted Avoidance of Help Seeking. Further, β_{1j} , β_{2j} , and β_{3j} are the slopes or effects of respective level-1 predictors, and r_{ij} is the random effect (or residual) for student i nested in classroom j . The residual term is assumed to be normally distributed with a mean of 0 and variance of σ^2 . The term γ_{00} represents the Avoidance of Help Seeking score for a male student (coded as 0) whose mathematics attitude, perceived teacher support, and age is at the grand mean. The terms in the equation above, $\gamma_{00} \dots \gamma_{40}$, represent intercepts associated with respective slopes. The term γ_{21} represents the effect of the teacher's sex on the professorial concern slope. The error term u_{0j} is the random effect associated with average help seeking (or avoidance).

Limitations

HLM has a few drawbacks. Researchers using this statistical method are warned to take great care when exploring data (see, e.g., Pedhazur, 1997; Roberts, 2004). This statistical technique often comes with difficulty in interpretation and generalizability. Just because the data appear to indicate that model specifications should be made does not imply that these specifications will be interpretable. In the instance of adding additional parameters to a model, there is a trade-off—between increasing the parameters and decreasing the level of precision. As Kreft and deLeeuw (1998) explained, “If too many parameters are estimated in one single model, precision suffers so much that the results are rendered useless for prediction” (p. 14).

In addition to interpretation, one must address whether HLM is actually superior to regular OLS regression techniques. A large intraclass correlation might justify the need to use HLM, but a large intraclass correlation does not presume the HLM parameter estimates will be

much different from OLS estimates—only that individual student scores depend greatly on the context (e.g., the school).

Last, HLM has enjoyed extensive use in the social and behavioral sciences recently, and as it continues to grow so will its familiarity and use. However, Goldstein (1995) reminded researchers to be cautiously vigilant, for the technique may become so en vogue that:

Its use will be a requirement of journal editors, or even worse, that the mere fact of having fitted a multilevel model will become a certificate of statistical probity. That would be a great pity. These models are [only] as good as the data they fit; they are powerful tools, not universal panaceas. (p. 202)

Quantitative education research more broadly is not without limitations and could perhaps even be dangerous. Arguably, this area of research has done the most harm to African Americans—painting us as genetically inferior to Whites, inherently less intelligent, mathematically deficient, or lacking the personality traits associated with academic motivation (see, e.g., Jefferson, 1787; Kopan, 2015; Powell, 2012; Valencia, 2002). Most common in mathematics education research is the use of quantitative analysis as a tool to continue the “gap-gazing” (Gutiérrez, 2008) obsession where “data” are shown to illustrate just how far behind Black students are from their White counterparts. Prominent scholar and Egyptologist, Asa Hilliard (2003), suggested that the focus instead be on the *real* achievement gap—the gap between African Americans (and students) and *excellence*. Hilliard suggested that the “so-called” achievement gap never refers to the gap between African Americans and Asians, the gap between African Americans and Latinos, or the gap between African Americans and *any* other group than Europeans. Implicit, then, is that when achievement gap rhetoric is used, something more than just achievement is really being discussed. The problem with achievement gap

language is that it validates European ordinary achievement as the universal norm, even if this achievement is mediocre. In light of the fact that the United States ranks practically last in nearly all comparative international studies of achievement among developing countries (Perry et al., 2003), achievement gap rhetoric is hardly ever used to compare the norm group with the performance of, say, Asians. Indeed, a closer look at the norm group's achievement would expose its normative mediocrity. Hilliard posited that excellence should be a function of criterion levels of performance, not relative levels. The gap between the present level of performance for African American students and the criterion performance standard that should be required is the *real* academic achievement gap that should be closed. As Hilliard argued:

Too often, by using the European students' normative performance as the universal standard, not only do we use a low standard, but we tend to be satisfied with the performance of minority cultural groups when a substantial reduction in this gap occurs. The unconscious assumption seems to be that the traditional low performer cannot surpass—merely approach—the performance of the norm group. (p. 138)

Although this study focused on help-seeking behaviors and not achievement, per se, I was determined that my research would not contribute to the ever-present gap-gazing discourse. I would not be researching the help seeking behaviors of my Black students and comparing it to that of their White counterparts. There may or may not be differences between the groups, but this comparison is of little importance to me. I echo the sentiments of Gutiérrez when she asserted that Black students at the community college are worth studying in their own right and that a comparison group is not necessary.

Last, in quantitative research, the researcher is expected to be detached and objective (Duffy, 1986). Some quantitative methods could require little to no contact with the participants

at all. Indeed, I could administer each survey instrument to the participants of this study without ever seeing the students. And although this detachment could be seen as a strength of quantitative education research (because of its *assumed* way of preventing bias), it could also be seen as a weakness. As Carr (1994) stated, “The [quantitative] methodology dismisses the experiences of the individual as unimportant...and regards human beings as merely reacting and responding to the environment” (p. 718). I argue, however, that the stories of students enrolled in College Algebra and how they navigate the risk of seeking help *is* important, and though the scholarship on help-seeking behaviors in college mathematics classrooms is widely understood using quantitative methods, future research on the subject might be greatly enhanced using qualitative methods as well.

CHAPTER 5

RESULTS

Here again, I begin the chapter with a restatement of both the purpose and the research questions that guided the inquiry.

This study investigated factors that influence the help-seeking behaviors of students in their first credit-bearing mathematics class at the community college. Specifically, I investigated the help-seeking practices of African American community college students in the Atlanta Metropolitan and central Georgia⁹ areas who were enrolled in College Algebra. Two questions, explored through HLM, guided the inquiry:

1. Do different student characteristics (e.g., attitude toward mathematics, the perception of the instructor as supportive, gender, age, enrollment status, or classification) influence help-seeking behaviors?
2. Do classroom characteristics (e.g., collective attitude toward mathematics, the collective perception of the instructor as supportive, or teacher gender) influence help-seeking behaviors?

Demographic Characteristics

There were 544 students participating in the study who identified as Black or African American. Nearly a fifth of these participants (103), however, exhibited straightlining: what Herzog and Bachman (1981) describe as the tendency to use identical responses for all items in a set. More specifically, these participants selected the lowest rating for each of the scales in the survey instrument. Consistent with the findings of Zhang and Conrard (2014), these participants

⁹ Though help-seeking behaviors from all community colleges in Georgia may be useful, I have specifically chosen colleges in these areas because of their high population of African American students.

were also identified as speeders who completed the survey well below the 30-minute predicted completion that Qualtrics calculated. To obtain more meaningful results and a true contribution to the understanding of students' help-seeking behaviors, these results were deleted. Of the remaining 441 participants, 78 of them failed to complete the survey instrument in its entirety. More specifically, these participants dropped out in the middle of the survey. These cases were treated as missing completely at random (see, e.g., Newman, 2014) and consequently deleted. Thus, the final number of participants for this research study was 361 students between the ages of 18 to 69 ($M = 28.35$, $SD = 11.20$) nested within 48 classrooms. Demographic characteristics of the participants such as age, gender, completion of developmental education, and enrollment status were captured in the online survey. The results are summarized below in Table 5.1.

Table 5.1
Descriptive Statistics for Participant Demographics

Categorical Variables	<i>N</i>	Percentage
Gender		
Male (0)	81	22.44
Female (1)	280	77.56
Enrollment Status		
Full-time (1)	223	61.77
Part-time (0)	138	38.23
Developmental Status		
Developmental (1)	140	38.78
Not Developmental (0)	221	61.23
Continuous Variable	<i>M</i>	<i>SD</i>
Age	28.35	11.20

The majority of the participants were female (78%), attended school full-time (62%), and did not complete any developmental mathematics courses (61%).

Outcome Variables

College Algebra Help Seeking Scales

The participants completed College Algebra Help Seeking subscales—Instrumental Help Seeking, Executive Help Seeking, and Avoidance of Help Seeking. These outcomes represent the dependent variables. As mentioned in Chapter 4, these scales were adapted from the Computer Science Help Seeking Scales created by Cheong, Pajares, and Oberman (2004). The mean score for the Instrumental Help Seeking scale ($M = 65.56$, $SD = 12.8$) is nearly three times as high as the mean score for Executive ($M = 22.35$, $SD = 17.9$) and the Avoidance ($M = 25.98$, $SD = 16.72$) of Help Seeking scales. Thus, it appears that the participants of this study reported that they engage in Instrumental Help Seeking behaviors more than the others.

Bivariate relationships between the outcome variables were examined. These correlations are presented in Table 5.2.

Table 5.2
Bivariate Relationships of Instrumental, Executive, and Avoidance of Help Seeking

Variable	1	2	3
1. Instrumental	1.00	-.41	-.26
2. Executive	-.41	1.00	.46
3. Avoidance	-.26	.46	1.00

The analysis revealed that there was moderate to weak correlation among the outcome variables, with the largest correlation ($r = .46$) existing between Executive and Avoidance of Help Seeking. That is, an increase in Executive Help Seeking was associated with an increase in Avoidance of Help Seeking.

Items on the Instrumental, Executive, and Avoidance of Help Seeking scales were rated on an eight-point Likert-type scale with responses ranging from 1 = *Most definitely false* to 8 = *Most definitely true*. Each student's Instrumental, Executive, and Avoidance of Help Seeking

score is the sum of their responses, where higher scores indicate higher Instrumental, Executive, and Avoidance of Help Seeking. The mean and standard deviation for each scale, as well as for each item in the scale are listed in Tables 5.3, 5.4, and 5.5.

Table 5.3
Instrumental Help Seeking Results (10 Items)

Item	<i>M</i>	<i>SD</i>
Instrumental Help Seeking (Total)	65.56	12.84
1. When I ask my College Algebra teacher for help, I prefer to be given hints or clues rather than the answer.	5.68	2.29
2. When I am having trouble and ask the College Algebra teacher for help, I like to be given examples of similar problems we have done.	6.97	1.57
3. When I ask the teacher for help with something I don't understand, I ask the teacher to explain it to me rather than just give me the answer.	7.15	1.40
4. When I ask my teacher for help in this class, I only want as much help as necessary to complete the work myself.	6.23	1.98
5. When I ask my teacher for help understanding the material in this class, I prefer that the teacher help me understand the general ideas rather than simply tell me the answer.	6.93	1.61
6. When I ask a student for help with my College Algebra work, I don't want that student to give away the whole answer.	6.22	2.08
7. When I ask a student for help understanding the material in this class, I prefer that the student help me understand the general ideas rather than simply tell me the answer.	6.64	1.79
8. When I ask a student for help in this class, I want to be helped to complete the work myself rather than have the work done for me.	6.78	1.79
9. When I ask a student for help in this class, I prefer to be given hints or clues rather than the answer.	6.19	2.08
10. When I ask a student for help with something I don't understand, I ask the student to explain it to me rather than just give me the answer.	6.76	1.75

Table 5.4
Executive Help Seeking Results (10 Items)

Item	<i>M</i>	<i>SD</i>
Executive Help Seeking (Total)	22.35	17.39
1. When I ask the teacher for help in this class, I prefer that the teacher do the work for me rather than explain to me how to do it.	2.41	2.13
2. When I ask my teacher for help on something I don't understand, I prefer that the teacher do it for me.	2.32	2.06
3. When I ask my teacher for help on something I don't understand, I prefer the teacher to just give me the answer rather than to explain it.	2.10	1.96
4. When I ask the teacher for help with my work, I prefer to be given the answer rather than an explanation of how to do the work myself.	2.22	2.02
5. When I ask my teacher for help, I want the teacher to do the work for me rather than help me be able to complete the work myself.	2.08	1.83
6. When I ask a student for help on something I don't understand, I prefer that student to just give me the answer rather than to explain it.	2.33	2.01
7. When I ask a student for help with my work, I prefer that the student do the work for me rather than explain to me how to do it.	2.22	1.95
8. When I ask another student for help on something I don't understand, I ask that student to do it for me.	2.18	1.93
9. When I ask a student for help in this class, I want the work done for me rather than be helped to complete the work myself.	2.24	1.99
10. When I ask a student for help with my work, I prefer to be given the answer rather than an explanation of how to do the work myself.	2.25	2.01

Table 5.5
Avoidance of Help Seeking Results (9 Items)

Item	<i>M</i>	<i>SD</i>
Avoidance of Help Seeking (Total)	25.98	16.72
1. I don't ask for help in this class even when the work is too hard to solve on my own.	3.59	2.36
2. If I need help to do a College Algebra problem, I prefer to skip it rather than to ask for help.	3.07	2.19
3. I don't ask for help in this class even if I don't understand the lesson.	3.13	2.36
4. If I didn't understand something in this class, I would guess rather than ask someone for help.	3.15	2.31
5. I would rather do worse on an assignment I couldn't finish than ask for help in this class.	2.42	2.06
6. Even if the work was too hard to do on my own, I wouldn't ask for help in this class.	2.61	2.14
7. I would put down any answer rather than ask for help in this class.	2.57	2.14
8. I don't ask questions in this class even if I don't understand the lesson.	2.95	2.33
9. If work in this class is too hard, I don't do it rather than ask for help.	2.49	2.13

Predictor Variables

Attitude Toward Mathematics

Students also completed the Attitude Toward Mathematics Inventory (ATMI) created by Tapia (1996) meant to gauge students' sense of security, value, motivation, and enjoyment when it comes to mathematics. The format for all items in the inventory is a 5-point scale, ranging from 1 = *strongly disagree* through 5 = *strongly agree*. Attitude Toward Mathematics was used as one of the student-level predictors of academic help seeking, and the aggregate of this variable was used as one of the classroom-level predictors of academic help seeking as a contextual measure. Each student's score is a sum of their responses, where higher scores indicate a more positive attitude toward mathematics. The mean and standard deviation for this scale, as well as for each item in the scale are listed in Table 5.6.

Professorial Concern

Finally, students completed the Professorial Concern subscale of the College Classroom Environment Scales created by Winston, Vahala, Nichols, and Gillis (1994). Professorial Concern, like Attitude Toward Mathematics, was also used as a student-level predictor of academic help seeking; the aggregate of this variable was used as one of the classroom-level predictors of academic help seeking. On this scale, students can answer 1 = *Never or almost never true*, 2 = *Seldom true*, 3 = *Occasionally true*, 4 = *Often true*, or 5 = *Always or almost always true*, where high scores on it describe an academic environment where students perceive the instructor as being personally concerned about them as individuals and as striving to foster their education and personal achievement. The instructor is perceived as being friendly, caring, and open—as showing empathy in her (or his) interactions, and as respecting students' ideas. The mean and standard deviation for this scale, as well as for each item in the scale are listed in Table 5.7.

Each of the scales in this research study proved highly reliable. The Cronbach alpha coefficient was .88 for Instrumental Help Seeking, .97 for Executive Help Seeking, and .95 for Avoidance of Help Seeking. Additionally, the Cronbach alpha coefficients for Attitude Toward Mathematics and Professorial were .98 and .95, respectively. It bears noting that scores on each of the scales were on par with previous scholarship utilizing these scales (see Cheong, Pajares, & Oberman, 2004; Wimer & Levant, 2011) and that scores on the Executive and Avoidance of Help Seeking scales were even more reliable. Cronbach alphas, means, and standard deviations for all scales used in this study are presented in Table 5.8. Additionally, descriptive statistics for all classroom-level variables are presented in Table 5.9.

Table 5.6
Attitude Toward Mathematics Inventory Results (40 Items)

Item	<i>M</i>	<i>SD</i>
Attitude Toward Mathematics Inventory (Total)	25.98	16.72
1. I get a great deal of satisfaction out of solving a mathematics problem.	3.51	1.29
2. I have usually enjoyed studying mathematics in school.	3.02	1.41
3. Mathematics is dull and boring.	3.28	1.22
4. I like to solve new problems in mathematics.	3.21	1.23
5. I would prefer to do an assignment in mathematics than to write an essay.	3.22	1.52
6. I really like mathematics.	3.06	1.38
7. I am happier in a mathematics class than in any other class.	2.54	1.30
8. Mathematics is a very interesting subject.	3.32	1.28
9. I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in mathematics.	3.20	1.22
10. I am comfortable answering questions in mathematics class.	3.28	1.30
11. I am confident that I could learn advanced mathematics.	3.17	1.36
12. I would like to avoid using mathematics in university.	3.01	1.28
13. I am willing to take more than the required amount of mathematics.	2.52	1.25
14. I plan to take as much mathematics as I can during my education.	2.42	1.22
15. The challenge of mathematics appeals to me.	2.93	1.26
16. Mathematics is one of my most dreaded subjects.	2.77	1.43
17. My mind goes blank and I am unable to think clearly when working with mathematics.	3.04	1.33
18. Studying mathematics makes me feel nervous.	2.93	1.34
19. Mathematics makes me feel uncomfortable.	3.11	1.31
20. I am always under a terrible strain in a mathematics class.	3.09	1.35
21. When I hear the word mathematics, I have a feeling of dislike.	3.15	1.33
22. It makes me nervous to even think about having to do a mathematics problem.	3.22	1.36
23. Mathematics does not scare me at all.	2.97	1.32
24. I expect to do fairly well in any mathematics class I take.	3.40	1.19
25. I am always confused in my mathematics class.	3.19	1.27
26. I have a lot of self-confidence when it comes to mathematics.	2.98	1.27
27. I am able to solve mathematics problems without too much difficulty.	2.97	1.20
28. I feel a sense of insecurity when attempting mathematics.	3.00	1.29
29. I learn mathematics easily.	2.91	1.23
30. I believe I am good at solving mathematics problems.	3.15	1.21
31. Mathematics is a very worthwhile and necessary subject.	3.66	1.16
32. I want to develop my mathematical skills.	3.75	1.10
33. Mathematics helps to develop the mind and teaches a person to think.	3.94	.93
34. Mathematics is important in everyday life.	3.85	1.01
35. Mathematics is one of the most important subjects for people to study.	3.59	1.13
36. College mathematics lessons would be very helpful no matter what I decide to study in future.	3.43	1.11
37. I can think of many ways that I use mathematics outside of school.	3.56	1.10
38. I think studying advanced mathematics is useful.	3.13	1.19
39. I believe studying mathematics helps me with problem solving in other areas.	3.54	1.10
40. A strong mathematics background could help me in my professional life.	3.63	1.14

Table 5.7
 Professorial Concern Results (8 Items)

Item	<i>M</i>	<i>SD</i>
Professorial Concern (Total)	44.19	12.38
1. The professor is willing to assist students outside of class.	3.83	1.21
2. The professor tries to let the class know her or him as a person.	3.44	1.30
3. The professor recognizes students by name outside of class.	3.29	1.36
4. The professor shows genuine interest in students' performance in this class.	3.76	1.28
5. The professor spends time talking informally with students before and/or after class.	3.25	1.38
6. Students feel comfortable approaching the professor with problems they are having with the class.	3.80	1.27
7. Students' ideas and opinions are appreciated in this class.	3.85	1.23
8. The professor goes out of her or his way to help students who request it.	3.79	1.26
9. The professor seems to be understanding about students' personal problems and concerns.	3.62	1.30
10. The professor shows respect for students' opinions and points of view.	3.97	1.15
11. Students are encouraged to visit the professor in his or her office.	3.69	1.33
12. There are opportunities to contribute in class.	3.88	1.19

Table 5.8
 Cronbach Alphas, Means, and Standard Deviations for Scales

Scale	Alpha	<i>M</i>	<i>SD</i>
1. Instrumental Help Seeking	.88	65.56	12.84
2. Executive Help Seeking	.97	22.35	17.39
3. Avoidance of Help Seeking	.95	25.98	16.72
4. Attitude Toward Mathematics	.98	127.66	36.35
5. Professorial Concern	.95	44.19	12.38

Table 5.9
Descriptive Statistics for Classroom-level Variables

Continuous Variables	<i>M</i>	<i>SD</i>
Average Classroom Age	28.01	5.40
Average Attitude Toward Mathematics	127.42	15.37
Average Professorial Concern	44.19	6.09
Categorical Variable	<i>N</i>	Percentage
Teacher Sex		
Male (0)	11	22.9
Female (1)	37	77.1

Bivariate relationships between both student-level and classroom-level variables were also examined. The correlations among student- and classroom-level variables are presented Tables 5.9 and 5.10. The analysis revealed that there was moderate to weak correlation among the student-level variables, with the largest correlation ($r = .34$) existing between attitude toward mathematics and the perception of the instructor as supportive. Moreover, student age was moderately correlated ($r = .33$) with developmental status; that is, having taken a developmental studies mathematics class was associated with an increase in age.

Table 5.10
Bivariate Relationships between Student-level Variables

Variable	1	2	3	4	5	6
1. Attitude Toward Mathematics	1.00	.34	-.15	-.12	.04	-.20
2. Professorial Concern	.34	1.00	-.08	.05	-.06	-.01
3. Student Gender	-.15	-.08	1.00	.05	-.05	.09
4. Student Age	-.12	.05	.05	1.00	-.04	.33
5. Enrollment Status	.04	-.06	-.05	-.04	1.00	.01
6. Developmental Status	-.20	-.01	.09	.33	.01	1.00

Table 5.11
Bivariate Relationships between Classroom-level Variables

Variable	1	2	3	4
1. Collective Attitude Toward Mathematics	1.00	.44	-.06	-.03
2. Collective Professorial Concern	.44	1.00	-.10	.17
3. Average Classroom Age	.06	-.10	1.00	.19
4. Teacher Sex	-.03	.17	.19	1.00

At the classroom level (level-2), a bivariate relationship was also examined for four predictor variables. The analysis revealed that there was moderate to weak correlation among the outcome variables, with the largest correlation ($r = .44$) existing between Collective Attitude Toward Mathematics and Collective Professorial Concern. That is, an increase in a class's collective attitude toward mathematics was associated with an increase in the class's collective perception of the instructor as supportive.

Results of Analysis

To test the relationship between student-level characteristics, specifically, attitude toward mathematics and perception of the instructor as supportive, a hierarchical linear model was estimated using HLM 8 software with restricted maximum likelihood estimation with each of the help seeking scales as the dependent variable.

Avoidance Help Seeking

The initial analysis began with the generation of the unconditional model (again, where none of the level-1 or level-2 predictor variables were included). The fixed effect estimate of the intercept was 25.95 ($SE = 1.19$, $p < .001$). The results indicated that Avoidance of Help Seeking was different across classrooms ($\tau_{00} = 31.3$). Within classrooms, the amount of unexplained variance was larger than between-classrooms ($\sigma^2 = 250.05$). The intraclass correlation coefficient (ICC) was then computed using the formula

$$\begin{aligned} ICC &= \frac{\tau_{00}}{\tau_{00} + \sigma^2} \\ &= \frac{31.30}{31.30 + 250.05} \\ &\approx 0.11, \end{aligned}$$

where τ_{00} represents the between-classroom variance and σ^2 represents the within-classroom variance. This ratio of between-class variance and total variance indicated that approximately 11% of the variance in Avoidance of Help Seeking was between classes, providing justification for continued analysis with hierarchical linear modeling (Raudenbush & Bryk, 2002).

To answer the research questions, the student-level (level-1) variables were included in the model to establish whether their relationship with Avoidance of Help Seeking was significant. These variables were centered around the group mean (Enders & Tofghi, 2007). Table 5.12 shows the results of a random-coefficients model for each predictor variable, together with the variance components of within-and between-classrooms. Using the likelihood ratio test, random effects were individually checked and tested for each student-level variable; none of the random slopes were found to significantly improve model fit. The final explanatory model was built by combining all student-level and classroom-level variables to predict Avoidance of Help Seeking. In the full model, the analysis affirms that the student-level variables attitude toward mathematics, perception of the instructor as supportive, student age, and student gender were statistically significant explanatory variables while, at the classroom-level, teacher sex, average instructor supportiveness, and average classroom age were significant explanatory variables. The final explanatory model is given by the equation at level one,

$$\text{Avoidance}_{ij} = \beta_{0j} + \beta_{1j}\text{Attitude}_{ij} + \beta_{2j}\text{ProfConcern}_{ij} + \beta_{3j}\text{Age}_{ij} + \beta_{4j}\text{StudentFemale} + r_{ij},$$

and at level two,

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\text{TeacherFemale} + \gamma_{02}\text{AverageAge} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}\text{TeacherFemale}$$

$$\beta_{3j} = \gamma_{30}$$

$$\beta_{4j} = \gamma_{40}.$$

All variables (except for teacher sex) were centered at the grand mean so that the variance in the intercept term, β_{0j} , represents the between-classroom variance adjusted for the student-level variables (Hoffman & Gavin, 1998). To ensure tenability of results in this research yielded by HLM, the assumptions of both level-1 and level-2 were verified correspondingly. The analysis showed evidence of homogeneity of level-1 variance, as was indicated by the chi-square statistic of 104.24, with 47 degrees of freedom and $p > .05$. The assumptions of normality of level-1 and level-2 residuals were also checked through visual inspection and satisfied.

For each unit increase in attitude toward mathematics and professorial concern, Avoidance of Help Seeking decreased by an estimated .10 ($p < .001$) and .16 ($p < .05$) points respectively, controlling for the other variables in the model. Thus, students with a positive attitude toward mathematics and students who perceived their instructor as supportive avoided seeking help significantly less than students with negative attitudes toward mathematics and who did not perceive their instructor to be supportive.

For each year increase in age, Avoidance of Help Seeking decreased by .25 points ($p < .001$), suggesting that the older the student the less likely they were to avoid seeking help with their College Algebra coursework. Additionally, female students were predicted to score 3.13 points lower ($p < .05$) in Avoidance of Help Seeking than their male counterparts; that is, the women in this research study avoided seeking help less than men.

When considering significant level-2 predictors, Avoidance of Help Seeking was predicted to be 2.40 lower ($p < .05$) for students in classrooms with female instructors, controlling for the other variables in the model. Additionally, while controlling for the other variables in the model, each unit increase in average classroom age resulted in a .35 decrease in Avoidance of Help Seeking over and above individual student age.

Table 5.12
Parameter Estimates for Avoidance of Help Seeking

Fixed Effects	Null Model		Random-Coefficients Model		Final Model	
	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	25.95	1.19	28.73**	1.95	29.44**	2.15
Student-level						
Attitude			-.10**	.02	-.10**	.02
Professorial Concern			-.29**	.08	-.16*	.06
Student Age			-.26**	.08	-.25**	.08
Student Female			-3.59*	1.96	-3.13*	1.51
Classroom-level						
Teacher Female					-2.40*	.83
Average Student Age					-.35*	.07
TeacherSex × Professorial Concern					-.28*	.09
Variance Component	Estimate		Estimate		Estimate	
Student-level	31.30		37.38		35.12	
Classroom-level	250.05		213.13		210.96	

* $p < .05$, ** $p < .001$.

Thus, students in more mature classrooms avoided seeking help less than students in classrooms with a younger student population.

The interaction between Avoidance of Help Seeking and the student's perception of the instructor as supportive, depended on the instructor's sex. The analysis revealed that supportive instructors who were also women had a .28 reduction in the avoidance of help seeking than male instructors. The graph below (see Figure 5.1) illustrates this interaction. Avoidance of Help Seeking decreases regardless of the teacher's gender. However, after a certain point, high perceptions of the instructor as supportive result in a steeper slope in classrooms with female instructors than male instructors.

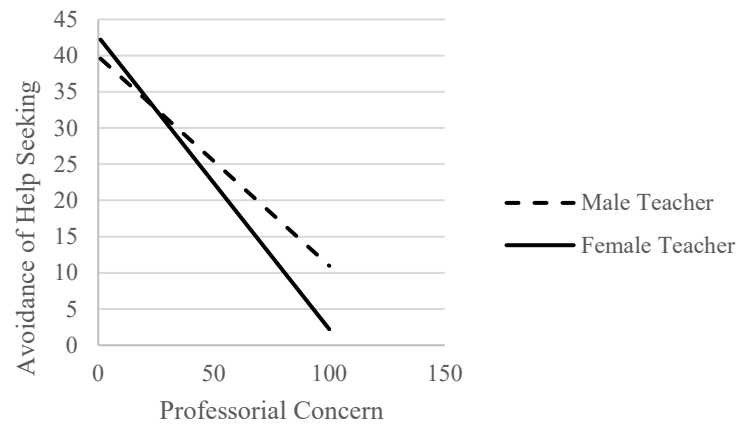


Figure 5.1. Interaction between Teacher Gender and Avoidance of Help Seeking

Instrumental Help Seeking

The initial analysis began with the generation of the unconditional two-level model. The fixed effect estimate of the intercept was 65.65 ($SE = .74, p < .001$). The results indicated that Instrumental Help Seeking did not vary across classrooms ($\tau_{00} = 4.25$), and the *ICC* was found to be

$$ICC = \frac{4.25}{4.25 + 160.77} \approx 0.026$$

With an *ICC* near zero, there was little between-classroom effect on Instrumental Help Seeking; consequently, the use of HLM was not appropriate. In fact, “the lower the *ICC*, the less difference will exist between HLM estimates compared to traditional regression techniques” (Garson, 2013, p. 27). Therefore, to address the first research question, a multiple regression analysis was performed. The results are discussed below.

A multiple regression analysis was used to test if student-level variables such as attitude toward mathematics, perception of the instructor as supportive, age, gender, enrollment status, and developmental status significantly predicted students’ Instrumental Help Seeking. The

results of the regression indicated that the predictors explained roughly 14% of the variation in Instrumental Help Seeking ($R^2 = .14, F_{6,353} = 79.28, p < .001$). It was found that attitude toward mathematics (mean-centered) significantly predicted (see Table 5.13) Instrumental Help Seeking ($\beta = .34, p < .001$), as did a student's age (also mean-centered) ($\beta = .11, p < .05$).

Table 5.13
Regression Analysis Predicting Instrumental Help Seeking

Variable	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
Attitude	.12	.02	.34	6.16	<.001**
Professorial Concern	.06	.06	.06	1.10	.27
Age	.12	.06	.11	2.02	.04*
Female	1.11	1.56	.04	.71	.48
Enrollment	-1.60	1.31	-.06	-1.22	.23
Developmental	-.80	1.40	-.03	-.57	.57

* $p < .05$, ** $p < .001$.

Instrumental Help Seeking was predicted to increase by .12 points for each unit increase in attitude toward mathematics score. That is, the more positive one's attitude toward mathematics, the more Instrumental Help Seeking they exhibited. Additionally, Instrumental Help Seeking was also predicted to increase by .12 points for each unit increase in age, controlling for the other variables. That is, older students exhibited more Instrumental Help Seeking than younger students.

Executive Help Seeking

As with Instrumental Help Seeking, the initial analysis began with the generation of the unconditional two-level model. The fixed effect estimate of the intercept was 22.26 ($SE = 1.01, p < .001$). The results indicated that Executive Help Seeking did not vary across classrooms ($\tau_{00} = 8.23$), and the *ICC* was found to be

$$ICC = \frac{8.23}{8.23 + 294.70} \approx 0.027.$$

Thus, there was little between-classroom effect on Executive Help Seeking; consequently, the use of HLM was not appropriate. As with Instrumental Help Seeking, multiple regression analysis was also used to test if these same student-level variables significantly predicted students' Executive Help Seeking.

Table 5.14
Regression Analysis Predicting Executive Help Seeking

Variable	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
Attitude	-.03	.03	-.05	-.91	.37
Professorial Concern	-.19	.08	-.13	-2.39	.02*
Age	-.21	.09	-.13	-2.42	.02*
Female	-3.58	2.21	-.09	-1.62	.11
Enrollment	1.07	1.86	.03	.58	.56
Developmental	5.28	1.98	.15	2.67	.01*

The results of the analysis indicated that the predictors explained roughly 6% of the variation in Executive Help Seeking ($R^2 = .06$, $F_{6,353} = 3.73$, $p = .001$). It was found that age significantly predicted (see Table 5.10) Executive Help Seeking ($B = -.19$, $p < .05$), as did a student's developmental status ($\beta = 5.28$ $p < .01$). Executive Help Seeking was predicted to significantly decrease by .21 points for each year increase in age. That is, older students exhibited less Executive Help Seeking than younger students. Additionally, Executive Help Seeking was predicted to be 5.28 points higher for students who took some type of developmental mathematics course. Professorial Concern was also a significant predictor of Executive Help Seeking ($p = .02$), which was predicted to decrease by .19 points for each point increase in professorial concern. That is, students who perceived their instructor to be supportive exhibited less executive help-seeking behavior.

Summary

In this chapter, an analysis of the data was performed to explore the relationships between student-level variables (e.g., attitude towards mathematics, perception of the instructor as supportive, age, gender, enrollment status) and classroom-level variables (e.g., average classroom age, teacher sex, and the collective perception of the instructor as supportive) on academic help seeking.

To identify the relationships between student- and classroom-level variables on Avoidance of Help Seeking, a HLM was estimated. The analysis revealed attitude toward mathematics, perception of the instructor as supportive, age, and student gender to be significant student-level predictors and average classroom age and teacher gender to be significant classroom-level predictors.

Chapter 6 provides additional insight into the findings and offer conclusions. This final chapter also discusses implications for college (mathematics) instructors based on this research study and provides suggestions for future research in academic help seeking.

CHAPTER 6

DISCUSSION

In this final chapter, I discuss the findings of the research study, summarizing the results that were presented in Chapter 5. Additionally, I discuss the limitations of this research study, provide recommendations for future research on academic help seeking, and culminate with implications and closing thoughts.

Summary of the Study

When students struggle with their coursework, they may work independently to reread the textbook more slowly, review their notes and previous examples worked during class, or even search the Internet for additional resources. If these efforts are insufficient, they may consult their teacher or peers for assistance. That is, students may explore or utilize resources beyond themselves to acquire the information that will aid them in completing a task or solving a problem—a behavior called academic help seeking (Ogan, Walker, Baker, Rodrigo, Soriano, & Castro, 2015).

After a thorough review of the literature on academic help seeking, specifically with college mathematics, there were few studies that addressed academic help seeking with community (or technical) college students—students that are often different from K–12 and university students on which most of the extant literature focuses. Community college students tend to be non-traditional students in the sense that some do not enter college immediately after high school. They may have spouses and children, work fulltime jobs, or even be caregivers for their loved ones—responsibilities of older adults, which many community college students to be. Moreover, the current literature on academic help seeking is dominated with research participants from schools with little African American representation. Thus, this study sought to

investigate the factors that may (or may not) influence the College Algebra help-seeking behaviors of African American community college students.

The research study included a total of 321 participants from 48 College Algebra classrooms at selected community colleges in the Atlanta Metropolitan and central Georgia areas. An online survey, created and administered using Qualtrics, was used to collect data toward the end of the Fall 2018 semester. Data were collected using three instruments meant to capture help seeking behaviors and two instruments meant to capture students' mathematics attitudes and perception of their instructor as supportive. Adapted from the Computer Science Help Seeking Scales (Cheong, Pajares, & Oberman, 2004), students completed the following College Algebra Help Seeking Scales: Instrumental, Executive, and Avoidance of Help Seeking. Additionally, students completed the Attitude Toward Mathematics Inventory (Tapia, 1996) and the Professorial Concern Subscale of the College Classroom Environment Scales (Winston, Vahala, Nichols, & Gillis, 1988, 1989).

Findings

Demographics

There were 544 students who participated in the research study who identified as Black or African American. After deleting participants who exhibited straightlining (see Chapter 5) and participants who dropped out before completing the survey, the grand total was 361 Black or African American students nested within 48 classrooms. Demographic information such as age, sex, enrollment status (i.e., fulltime, part-time), and completion of developmental education were collected. The average age of the participants was roughly 28 years old, giving credence to the idea that the community college student is typically non-traditional. Additionally, most of the

participants were female students who were enrolled fulltime and never completed a developmental education mathematics course.

Student-level Predictors of Avoidance of Help Seeking

The first research question sought to understand what, if any, student-level variables influenced academic help seeking. The analysis showed that a student's age, sex, attitude toward mathematics, and professorial concern (perception of their instructor as supportive) significantly predicted their avoidance of College Algebra help seeking. Controlling for the other variables, older students exhibited less avoidance of help seeking. As mentioned earlier, community college students tend to be older, non-traditional students who may work in addition to taking classes. Perhaps older students avoid seeking help less than younger students because they feel they have more to lose by not understanding the College Algebra concepts enough to pass the class—especially if the student is in a selective-admissions program.

As it relates to sex, though findings on gender differences in academic help seeking are somewhat inconsistent, I expected that there would be differences in avoidance of help seeking between female and male students. Indeed, the present study found that female students avoided seeking help less than male students, a finding consistent with studies by Cheong and colleagues (2004) and Ryan and colleagues (1998). A possible explanation for this finding could be the social costs of seeking help—threats to public impressions and self-esteem. Lee (2002) explains that men are socialized to exhibit competence and independence—two ideas that are more consistent with public ideas of masculinity. Thus, for a male student to seek help would undermine this public impression.

Lastly, attitude toward mathematics and professorial concern significantly predicted avoidance of help seeking. That is, students with a more positive attitude toward mathematics

exhibited less avoidance of help seeking. Moreover, students who perceived their instructor to be supportive also exhibited less avoidance of help seeking—a finding consistent with the literature (see, e.g., Ryan et al., 1998).

Student-level Predictors of Instrumental and Executive Help Seeking

A student exhibits instrumental help seeking when they ask for just enough help so that they can learn independently and not just get the right answer. As described in Chapter 2, instrumental help seeking is an adaptive behavior (in contrast to executive help seeking, which is a maladaptive behavior) in which, ideally, educators want their students to engage. The present study found that attitude toward mathematics and age significantly predicted instrumental help seeking. That is, the more positive one's attitude toward mathematics, the more they reported engaging in instrumental help seeking. Additionally, as age increased, so did the amount of reported instrumental help seeking.

A student exhibits executive help seeking (sometimes called expedient or excessive help seeking) when they ask for help only to get the right answer and want to expend little to no effort. In contrast to instrumental help seeking, this type of help seeking behavior is one that educators want their students to avoid in most cases. The present study found that professorial concern, age, and developmental status significantly predicted executive help seeking. The more supportive students perceived their instructor to be the less they reported engaging in executive help seeking behaviors. Moreover, as age increased, the less students reported engaging in executive help seeking. Lastly, students who took some type of developmental mathematics course, reported engaging in executive help seeking 5.3 points higher than students who did not take developmental mathematics. As developmental education students tend to be more academically underprepared, they are also more likely to have self-regulated learning

deficiencies (see, e.g., Young & Ley, 2013). Such deficiencies could be a possible explanation for why students in this study who took a developmental education mathematics course reported higher levels of executive help seeking.

Classroom-level Predictors of Help Seeking

While reported levels of instrumental and executive help seeking in this study did not vary significantly across classrooms, roughly 11% of the variation in reported levels of avoidance of help seeking did. A teacher's sex and the average classroom age significantly predicted reported levels of avoidance of help seeking. Controlling for the other variables in the model, avoidance of help seeking was 2.23 points lower in classrooms with female college algebra instructors. Additionally, classrooms with an older student population showed a reduction in reported levels of avoidance of help seeking.

Of particular interest is the interaction effect between professorial concern and teacher sex. That is, the effect of the student's perception of their instructor as supportive depended on the teacher's sex. The graph (Figure 5.1) in Chapter 5 illustrates this effect—showing that in classrooms with female teachers, higher perceptions of instructor supportiveness resulted in a reduction in the avoidance of help seeking at a faster rate than compared to classrooms with male teachers. These findings are consistent with literature that suggests students of both sexes find female teachers to be warmer, friendlier, and more approachable (see, e.g., Wimer, 2008).

Limitations

While this research has contributed to the understanding of African American community college students and their help-seeking behavior in College Algebra, this study is not without its limitations. A few such limitations are discussed below.

Sampling Bias

Though over 40,000 emails were sent to the students of the community (or technical) colleges in the Atlanta Metropolitan area, barely 2% participated in the survey. These 541 students represent a voluntary response sample, where the students themselves decide whether to participate. The drawback with this type of sample is that it usually attracts people with strong feelings about the issue in question, many times in either direction. Thus, it is quite possible that only students who felt strongly about help seeking in their College Algebra coursework or about how supportive they perceive their instructor to be (and wanted to voice this information) participated in the research study. Unfortunately, this type of non-probability sample is not likely to be representative of the entire population of African American community college students in the Atlanta Metropolitan.

In addition to the potential bias introduced from the voluntary sample, there is also bias to consider from self-reports, which Schwarz (1999) suggests is the primary source of data in social science research. Self-reports may introduce social desirability bias (see, e.g., Bowman & Hill, 2011) where participants tend to overreport desirable attitudes and behaviors and underreport undesirable ones. For example, when it comes to attitudes about mathematics, it is possible that a research participant may not want to admit (to a mathematics education researcher) that they hate mathematics or that they do not think it is useful or important. Thus, the student may not provide truthful information about her true attitude toward the subject. Similarly, the wording on the Instrumental and Executive Help Seeking Scales present a stark contrast—where it is clearly more desirable (at least in a student’s view) to report higher levels of one over the other. As Schwarz mentioned, “Minor changes in question wording, question format, or question context

can result in major changes in the obtained results” (p. 93). Thus, students may have exaggerated their help-seeking behaviors.

Missing and Deleted Data

Answering a battery of over 70 survey questions about their mathematics attitudes and help-seeking behaviors is not necessarily an easy task. It involves research participants recognizing the intent of each question, recollecting relevant memories about their College Algebra experience, and compiling this information to make a summary judgment. Ideally, research participants would go through these steps and provide quality information, but factors such as task difficulty and motivation could tempt them to compromise on just satisfactory answers rather than the optimal answer—a phenomenon coined “satisficing” by Krosnick (1999, p. 215). One such satisficing behavior is straightlining (see, e.g., Zhang & Conrad, 2014; Kim, Dykema, Stevenson, Black, & Moberg, 2019). Kim and colleagues (2019) stated that straightlining occurs when participants “give identical (or nearly identical) answers to items in a battery of questions using the same response scale” (p. 214). As mentioned in the previous chapter, over 100 students exhibited straightlining behavior by selecting the lowest responses for each scale and finished the survey well below the average completion time. These responses reduced the quality of the data and did not truly contribute to the understanding of College Algebra help seeking. Thus, I made the decision to delete these results.

Additionally, 74 results were deleted because the students failed to complete the survey in its entirety. Generally, the quantitative research community discourages the practice of deleting missing data—advocating instead for other techniques such as imputation (see, e.g., Donders, van der Heijden, Stijnen, & Moons, 2006; Newman, 2014; Roderick, 1988). Imputation involves the idea of replacing missing data with predicted values obtained by using other known

characteristics about the research participants. However, because of the design of the survey instrument, all demographic questions (e.g., age, sex) were asked at the end of the survey, and all 74 participants quit the survey well before making it to these questions. Consequently, the missing data were treated as missing completely at random (MCAR) and deleted.

Suggestions for Future Research

In reviewing the literature, many of the studies on academic help seeking have been quantitative in nature and focused on K–12 students and university students from large public colleges and universities with few African American participants. Future research in academic help seeking would benefit from an increased focus on community (or technical) college students—a population that is noticeably absent from the literature. Instead of focusing on academic help seeking in such a broad sense, I recommend more studies that focus on the mathematics help-seeking behaviors of college students—perhaps even at historically black colleges and universities (HBCUs), a segment of the American student population that is also noticeably missing from the extant literature.

In addition to expanding the student population to community college students and students from HBCUs, future research in academic help seeking could benefit from more qualitative analysis. While the variables in this quantitative study explain a portion of the variance in help seeking, there are certainly other factors that may influence academic help seeking that quantitative analysis does not capture. For example, many of my students have expressed the inability to receive help from the tutoring center or from me personally (during my office hours) because of work schedule conflicts. While I operate on a 9-to-5 schedule, many community college students miss this window because they are only able to engage with their College Algebra coursework later in the evenings after fulfilling work and family obligations.

Qualitative analysis of College Algebra help seeking would take as its starting point the first-hand experiences of the research participants and allow such accounts as my students' to be voiced.

Implications and Closing Thoughts

I was asked toward the end of my recent interview for a teaching position in the department of mathematics at Clayton State University, "How do you get students to come to your office hours?" I chuckled in response because this question reaffirmed my commitment to researching academic help seeking and showed me that the help seeking dilemma transcends the type of college one attends; college instructors everywhere struggle to get their students to seek the help they need when it comes to their mathematics coursework.

To reduce attrition and retain students, many colleges have implemented early alert programs (see, e.g., Cai, Lewis, & Higdon, 2015; Tampke, 2013), where instructors can identify at-risk students and intervene before the student has to drop out because of academic difficulties. Students who struggle with mathematics coursework are often referred to tutoring for additional help; when colleges understand the factors that influence student help seeking, they can refine their departments, classrooms, and instructional practices in ways that foster and encourage help seeking—improving student academic success and, in turn, retention. In a study of elementary, high school, and college teachers, Marston (2010) found that even college professors cited enjoyment in teaching one's subject and satisfaction from working with students and watching them learn as "the most powerful motivators in their decision to remain in the classroom" (p. 9). Certainly, not all college instructors teach for these reasons; for those who do, however, knowing that the way students perceive them could influence whether the student seeks help should be enough to compel college instructors to take serious introspection.

The purpose of this research study was to investigate the factors that may (or may not) influence the College Algebra help-seeking behaviors of African American community college students. More specifically, it sought to examine the relationship between student-level and classroom-level variables on academic help seeking. The findings indicated a significant relationship between academic help seeking and the following student-level variables: attitude toward mathematics, professorial concern (the student's perception of the instructor as supportive), age, and sex. The findings also indicated a significant relationship between academic help seeking and the following classroom-level variables: teacher sex and average classroom age.

By understanding these relationships, faculty, senior leadership, and curriculum developers can begin breaking down barriers between them and their students and begin creating spaces where students feel comfortable and encouraged when asking for help. It is my hope that this project gives voice to students of community colleges in the Metropolitan Atlanta and central Georgia areas as well as to students at community colleges throughout the United States; they have been missing from the conversations around academic help seeking for too long. As an African American male, too often written off by my teachers as a problem, it is also my hope that this study shows the academic help seeking research community that the help seeking experiences of African American students deserve to be studied in their own right and that a comparison group is not always necessary (Gutiérrez, 2008). Lastly, I hope (college mathematics) educators can use the findings of this research study to continue to help African American students (and all students) recognize their brilliance (China, 2014; Leonard & Martin, 2013) and to realize that they are doers and creators of mathematics, capable of meaningful participation in the discipline.

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APPENDIX A

Attitudes Towards Mathematics Inventory (ATMI)

Directions: This inventory consists of statements about your attitude towards mathematics. There are no correct or incorrect responses. Please think *briefly* about how you regard each statement.

Please use these response codes:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral/No Opinion	Agree	Strongly Agree

1. I get a great deal of satisfaction out of solving a mathematics problem.
2. I have usually enjoyed studying mathematics in school.
3. Mathematics is dull and boring.
4. I like to solve new problems in mathematics.
5. I would prefer to do an assignment in mathematics than to write an essay.
6. I really like mathematics.
7. I am happier in a mathematics class than in any other class.
8. Mathematics is a very interesting subject.
9. I am comfortable expressing my own ideas on how to look for solutions to a difficult problem in mathematics.
10. I am comfortable answering questions in mathematics class.
11. I am confident that I could learn advanced mathematics.
12. I would like to avoid using mathematics in university.
13. I am willing to take more than the required amount of mathematics.
14. I plan to take as much mathematics as I can during my education.
15. The challenge of mathematics appeals to me.
16. Mathematics is one of my most dreaded subjects.
17. My mind goes blank and I am unable to think clearly when working with mathematics.
18. Studying mathematics makes me feel nervous.
19. Mathematics makes me feel uncomfortable.
20. I am always under a terrible strain in a mathematics class.
21. When I hear the word mathematics, I have a feeling of dislike.
22. It makes me nervous to even think about having to do a mathematics problem.
23. Mathematics does not scare me at all.
24. I expect to do fairly well in any mathematics class I take.
25. I am always confused in my mathematics class.
26. I have a lot of self-confidence when it comes to mathematics.
27. I am able to solve mathematics problems without too much difficulty.
28. I feel a sense of insecurity when attempting mathematics.
29. I learn mathematics easily.

30. I believe I am good at solving mathematics problems.
31. Mathematics is a very worthwhile and necessary subject.
32. I want to develop my mathematical skills.
33. Mathematics helps to develop the mind and teaches a person to think.
34. Mathematics is important in everyday life.
35. Mathematics is one of the most important subjects for people to study.
36. College mathematics lessons would be very helpful no matter what I decide to study in future.
37. I can think of many ways that I use mathematics outside of school.
38. I think studying advanced mathematics is useful.
39. I believe studying mathematics helps me with problem solving in other areas.
40. A strong mathematics background could help me in my professional life.

APPENDIX B

The College Algebra Help Seeking Scales (CAHSS)

Directions: Please use the following scale to answer the statements below. Select the number that best describes how true or false each statement is for you.

1	2	3	4	5	6	7	8
Definitely False							Definitely True

Instrumental Help Seeking

1. When I ask my College Algebra teacher for help, I prefer to be given hints or clues rather than the answer.
2. When I am having trouble and ask the College Algebra teacher for help, I like to be given examples of similar problems we have done.
3. When I ask the teacher for help with something I don't understand, I ask the teacher to explain it to me rather than just give me the answer.
4. When I ask my teacher for help in this class, I only want as much help as necessary to complete the work myself.
5. When I ask my teacher for help understanding the material in this class, I prefer that the teacher help me understand the general ideas rather than simply tell me the answer.
6. When I ask a student for help with my College Algebra work, I don't want that student to give away the whole answer.
7. When I ask a student for help understanding the material in this class, I prefer that the student help me understand the general ideas rather than simply tell me the answer.
8. When I ask a student for help in this class, I want to be helped to complete the work myself rather than have the work done for me.
9. When I ask a student for help in this class, I prefer to be given hints or clues rather than the answer.
10. When I ask a student for help with something I don't understand, I ask the student to explain it to me rather than just give me the answer.

Executive Help Seeking

1. When I ask the teacher for help in this class, I prefer that the teacher do the work for me rather than explain to me how to do it.
2. When I ask my teacher for help on something I don't understand, I prefer that the teacher do it for me.
3. When I ask my teacher for help on something I don't understand, I prefer the teacher to just give me the answer rather than to explain it.
4. When I ask the teacher for help with my work, I prefer to be given the answer rather than an explanation of how to do the work myself.
5. When I ask my teacher for help, I want the teacher to do the work for me rather than help me be able to complete the work myself.

6. When I ask a student for help on something I don't understand, I prefer that student to just give me the answer rather than to explain it.
7. When I ask a student for help with my work, I prefer that the student do the work for me rather than explain to me how to do it.
8. When I ask another student for help on something I don't understand, I ask that student to do it for me.
9. When I ask a student for help in this class, I want the work done for me rather than be helped to complete the work myself.
10. When I ask a student for help with my work, I prefer to be given the answer rather than an explanation of how to do the work myself.

Avoidance of Help Seeking

1. I don't ask for help in this class even when the work is too hard to solve on my own.
2. If I need help to do a College Algebra problem, I prefer to skip it rather than to ask for help.
3. I don't ask for help in this class even if I don't understand the lesson.
4. If I didn't understand something in this class, I would guess rather than ask someone for help.
5. I would rather do worse on an assignment I couldn't finish than ask for help in this class.
6. Even if the work was too hard to do on my own, I wouldn't ask for help in this class.
7. I would put down any answer rather than ask for help in this class.
8. I don't ask questions in this class even if I don't understand the lesson.
9. If work in this class is too hard, I don't do it rather than ask for help.

APPENDIX C

College Classroom Environment Scales (CCES)

Directions: Please indicate how frequently each of the following states are true of this class this term. Consider your responses carefully; respond as you honestly perceive this class, not as you wish it were. Do not spend a great deal of time pondering any particular statement. Use the scale below to record your answers. Please do not omit any items.

1	2	3	4	5
Never or Almost Never True	Seldom True	Occasionally True	Often True	Always or Almost Always True

Professorial Concern

1. The professor is willing to assist students outside of class.
2. The professor tries to let the class know her or him as a person.
3. The professor recognizes students by name outside of class.
4. The professor shows genuine interest in students' performance in this class.
5. The professor spends time talking informally with students before and/or after class.
6. Students feel comfortable approaching the professor with problems they are having with the class.
7. Students' ideas and opinions are appreciated in this class.
8. The professor goes out of her or his way to help students who request it.
9. The professor seems to be understanding about students' personal problems and concerns.
10. The professor shows respect for students' opinions and points of view.
11. Students are encouraged to visit the professor in his or her office.
12. There are opportunities to contribute in class.